









SURGICAL TECHNICS IN  
HOSPITAL PRACTICE.



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# SURGICAL TECHNICS

## IN HOSPITAL PRACTICE.

A HANDBOOK FOR HOUSE SURGEONS, STUDENTS, DRESSERS AND  
OTHERS ENGAGED IN HOSPITAL WORK.

BY

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## P R E F A C E .

THESE short essays are intended for junior men only. In writing them the author has attempted to systematize the routine duties of surgical hospital practice, and the general plan adopted has been to discuss, in order, the duties to the patient from the beginning to the end of his course of treatment.

Whatever usefulness they may have will appeal chiefly to the house-surgeon; but others whose work is in the ward and the theatre may also find them, in a measure, serviceable.

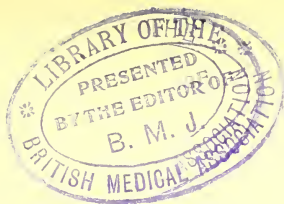
The Rules for Nurses which form the Appendix will be by no means suitable to the arrangements in every hospital, and they are given only as examples, which will require variation according to circumstances.

K. W. MONSARRAT,

LIVERPOOL,

*March. 1898.*





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# SURGICAL TECHNICS.

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## *I.*

### INTRODUCTORY.

**I**T is true of every Art, that to acquire a knowledge of its technical details makes great demands on the patience and conscientiousness of the student. The Art of Surgery shares this truth with the rest. The painter must study line work, must master colour, before any of the conceptions of which he finds himself in possession can be faithfully transmitted to his canvas. Even so, the student of Surgery has a laborious task before him before he can with confidence anticipate success in his treatment of a simple wound: with confidence, I repeat, because wounds sometimes seem to heal in defiance of the transgression of golden rules, and we are tempted to question, after all, the necessity for minute observation of detail in their treatment. Our doubts are, however, soon laid to rest. If we watch the progress of the transgressor we shall not have long to wait for an object lesson to illustrate the falseness of this

suggestion, in the shape of a surgical disaster. We may hear it ascribed to ill-luck (whatever that may mean in the mouth of a scientist), some accident, or some assistant ; but in reality it lies at the door of ignorance and carelessness. It is no less true, on the other hand, that we see this observation of detail here and there treated more as a ritual than as a means towards a definite scientific end. We see time wasted in the meaningless observances of a faddist rather than spent in the purposive precautions of a scientist. However, there is no excuse to be found in this for any carelessness in our own practice, and once our minds have grasped and accepted principles, we cannot honestly do less than follow them out to their full logical extent ; there must be no matters of indifference, and our method must contain within itself the realisation of these principles to their extreme limit.

It has been said that the days of brilliant surgery are over, and this is true in a sense. Past brilliancy was almost synonymous with rapidity ; surgical operations had something of the nature of lightning sketches, and there was little time available for the filling in of the details of the pictures.

But there is a brilliancy of to-day also, in which rapidity of execution has a minor though important place. The added time now available through the use of anæsthetics enables the surgeon to exercise a preciseness and a refinement in technique lately impossible, and herein lies the essence of latter-day brilliancy. Knowing also that the materials on which he exercises his art suffer from exposure, he retains rapidity amongst his principles, though the motive for it is not so direct and somewhat different since he has been able to avoid inflicting pain on his patient. Great demands are made upon him in these days, in proportion to the increase and accumulation of scientific facts bearing upon his art. He must show that reverent respect for the living tissues which is born of an intimate appreciation of the facts of Anatomy and Physiology, and he must realise to the full his personal responsibility in relation to the facts Bacteriology has taught him of the behaviour of his wounds. The limits of the field of operation having been so widely extended, he is called upon to handle an increased number of surgical instruments, but he must grasp the fact that it is not on these so much as on the better education of his own hands that he must rely, and that the most

cunningly contrived instrument cannot possibly take the place of manual dexterity. It would be but urging a platitude to dwell on the great fact of the intimate interdependence of all the structures of the human organism which he must learn, and to remind him that in endeavouring to ameliorate the condition of one he may injure another, so as to leave his patient in a worse condition than before.

In surgery, as in all else, boldness without rashness is a golden rule. We must remember that there is a right time for every operation, and must steer clear of either diffidence or overconfidence in our powers. Many patients are lost through temporising when the all valuable hour is passing ; many, too, through a too hasty undertaking when the time should be spent in preparation for it. Here, however, we are concerned not with these questions, but with the proper procedure after our minds have been made up as to the necessity and the time for it. These few essays might be entitled "The obligation of the surgeon to his wounds." As his acquaintance with them improves the enthusiasm of their study rises ; they are, if we may be permitted the expression, most satisfactory individuals to deal with, they



always meet one half-way, and their behaviour is ever both rational and sympathetic. No craftsman wins greater rewards in return for real and careful labour than does the surgeon, and if the opportunity of doing good work is the most valuable of all prizes, then he need envy no man's prospect.

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*II.***PERSONAL ASEPSIS.**

PERFECTION in the carrying out of the aseptic method is not learnt except by long practice of its details. The washing and re-washing of hands, the keeping inviolate of instruments and everything that comes near his wounds, and the slips and mistakes in the process that have so frequently to be rectified at first, make the beginner often ask himself whether all this observance is necessary and indispensable. Is anything more really necessary than a rough and ready use of antiseptic lotions and dressings? If he turn for re-assurance to his text-books on Pathology and Bacteriology, and to the later works on the treatment and behaviour of wounds, he will find "Yes" written in large letters on every page. Returning to his work with this conviction and carrying it out faithfully, he will find that by degrees the irksomeness passes, the slips become less and less frequent, and that the laboriously acquired habit is becoming a second nature to him.

The difference between a surgeon in whom this

happy change has taken place and one who has but a smattering of the method, is in no instance more evident than in the means taken to render and keep himself free from infecting agents. How often does one see in the middle of an operation or a dressing, the slip which betrays that either conviction is not supreme, or, worse still, that the accompanying sense of personal responsibility is absent. Even in these days one has also seen elaborate precautions looked upon more as a source of amusement and a standing joke against the conscientious surgeon than as essential to success. This, of course, is simply folly and ignorance combined. There is no half-way house on the road to Asepsis. The goal is not reached until every possible source of infection has been excluded, and there is no logical resting place on the way.

In ordinary polite cleanliness the surgeon should be the model of civilisation. Of course the daily bath must be his habit, and his linen unimpeachable always. There should be none to compare with him in these matters. To pass to details: it is certainly best that the hair on his face should be reduced to a minimum;

beards, however well kept, must collect dust, and also distribute it as the surgeon bends over his wound. Hands, of course, are of the greatest importance; nails are best cut with a regular nail-clipper, and should be kept short; the long nail one has seen praised as a useful surgical instrument, is an abomination. The nail brush is the best of all instruments for keeping them clean. Of the methods in use for disinfecting the hands, two will be given here. The first step of both methods is the use of soap, hot water and nail brush; soft green soap is efficient and convenient, and the whole extent of hand and arm that is to be exposed must be rubbed with this for some five minutes. If we choose the first method, turpentine is next taken in the palm of one hand and thoroughly rubbed into the skin of both by the two hands together, and then into the skin of the arms. If this rubbing process is continued for about two minutes, all the greasiness of the turpentine disappears. Some skins will not stand this application, and in that case either ether or 80 per cent. alcohol may be used in its place. The third stage is the immersion in antiseptic lotion; the one recommended is a 1-500 watery solution

of biniodide of mercury.\* Put shortly, the advantages of this lotion are, efficiency as a disinfectant, slight toxicity, absence of irritating properties, and the fact that it does not tarnish metal nor form albuminates in contact with the blood and tissue fluids. The hands require immersion in this for about three minutes, and of course are not dried when taken out.

Altogether, therefore, full ten minutes are required for the process. If the lotion mentioned above is not familiar or obtainable, its best substitute is the 1-500 solution of perchloride of mercury in 5 per cent. carbolic acid, commonly known as Lister's strong mixture.

The second method begins, as above, with a thorough use of soap and hot water; then the hands and arms are immersed in a solution of permanganate of potash for one minute and transferred from that to a saturated solution of oxalic acid in hot water, which removes the

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\* This solution is prepared as follows :—

R̄ Pot. Iodid.	℥ij		Aq. ad	℥lxxx
Hydr. Perchlor.	grs. xxiv			

Dissolve the iodide crystals in one pint of hot water, do the same with the sublimate crystals, and add the one solution to the other while hot. Make up to ℥lxxx. Other strengths are made in proportion.

stain of the permanganate, the oxalic acid itself being washed off in a bowl of sterilized water. This method is only convenient in the operating theatre, and is more complicated than the other, but it is searching and reliable. The success of either method depends on its thoroughness. The crevices under and about the nails are the parts that require most attention, and the direct use of a nail brush is chiefly to be relied on. Hands thus disinfected must be kept in their immaculate condition; and here it is the half-trained surgeon is so liable to transgress. Perhaps they unconsciously wander up to the moustache, or, worse still, are allowed to rest on an uncovered piece of blanket. All such sins are avoided by instinct by the experienced, and they will preserve their caste however tempted.

The most suitable dress for the operating theatre is, without a doubt, a linen overall sterilized by heat; and after each occasion on which it is used, it of course returns to the laundry and the sterilizer. Some hospitals do not, however, possess the necessary sterilizer, though, happily, their number is decreasing rapidly. In this case the best dress is one

made of "jaconette," reaching from above the collar to below the knees and buttoned behind at the neck and waist; the sleeves should be attached and reach half way down the upper arm, being finished off with elastic. This can be cleaned thoroughly by vigorous rubbing with lotion before and after use. It is certainly the most convenient form for use in the wards, and passing from case to case it can be rapidly cleansed. Dressing "coats," unless they are frequently washed, are altogether to be condemned, and the surgeon is much less likely to do harm in his shirt sleeves than attired in such a garment. The jaconette overall will require renewal of course from time to time as its surface becomes impaired and less non-absorptive.

If a surgeon takes the precautions detailed above, as far as present knowledge goes, he will have fulfilled all his obligations; if he does less he is not a safe man to be near any wound, however skilled his fingers may be in other respects. This is not a question which can be considered open. A man who does not practise a thorough and logical aseptic method to-day (we do not say any particular one), is not only behind the times, but is shewing culpable

ignorance. The germ "*theory*" can no longer be said to exist, it has been replaced by the "science" of Bacteriology, and yet it is astonishing to see the number of medical men who operate to-day without taking thorough and enlightened measures to exclude the possibility of contaminating their wounds. There is still a section of the profession who look upon aseptic precautions as something of the nature of a fad, and are content with an indiscriminate use of carbolic acid and iodoform, and think that they have then done all that can be required of them. And it must also be confessed that the teaching on this subject in our schools still leaves very much to be desired. There is considerable difference of opinion still about the practice of the method; one surgeon makes much greater use of antiseptic chemicals in his endeavour to procure asepsis than another; another uses heat and heat alone. Whatever the practice may be, thoroughness is what seems to be wanting to-day, and there is a general laxity in the way the chemical substances are used, which is unjustifiable in view of the present state of knowledge of their several actions and properties.



*III.***THE CHARGE OF THE PATIENT.****A.—BEFORE OPERATION.**

To look after the general cleanliness of the patient is one of the responsibilities of the nursing staff, and fortunately now-a-days its importance is generally recognised and its practice conscientiously carried out. It is, however, a rule incumbent on every surgeon that he should take nothing for granted, and find grounds for confidence before he places it in the work of others. It is universally the custom to give every patient a warm bath before admission to the surgical wards. This should not, of course, be entrusted to the patient himself, as his ideas on the subject of cleanliness may be of the most primitive kind; it should be under the supervision of some one instructed in the necessity for its thoroughness.

Should the patient not be in a fit condition to stand the exposure incident to this, it is the duty of the nurse to wash him in bed, and this is one of the first duties in which she is

instructed. In every ward it ought to be the practice to attend to the details of the patient's cleanliness on definite days; for instance, one day the head and hair are washed,\* on another nails are cut and scrubbed, and so on. The washing of the whole body, either in the bath or in bed, should be repeated once a week as a matter of routine. In the larger hospitals neither surgeon nor house surgeon will have occasion to inquire into these matters, they are understood and established practices, but this does not always obtain in smaller and provincial hospitals, and they will do well to assure themselves that they are satisfactorily carried out. Before every operation the amount of risk a patient is about to run should, as far as possible, be accurately estimated. To do this, careful examination of the various systems must be undertaken. Of course, when the operation is a trivial one this need not be extensive, but at least his urine should be tested for albumen and sugar, and his heart and lungs examined with the stethoscope.

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\* A 1-20 solution of carbolic acid in meth. spirit is a very suitable wash for ward use.

The behaviour of wounds depends very largely on the constitutional condition of the patient. On this subject Sir James Paget has written a classical essay which every surgeon might do well to learn by heart. The general effect of the operation is also a matter to be carefully anticipated, and for this purpose it is almost essential to have the patient under observation for some days previously. Once or twice one has seen an attack of *delirium tremens* follow the simple confinement and restraint, and if this plan of probation had not been carried out, the alcoholism itself would have been overlooked, with possibly a disastrous result. When the operation has been decided upon, special preparation is called for ; if it is to be one of any magnitude a plan such as the following should be carried out.

A warm bath is given on two consecutive nights before the day for operation, with a free use of soft green soap. The patient is not kept in for more than ten minutes. His hair is washed thoroughly the preceding day with the preparation before-mentioned, and nails and teeth are scrupulously cleaned. All other possible sources of infection are to be investigated, such as, for

instance, a discharge from the ear, which has more than once spoiled the result of operations about the neck. Clean linen is put on the bed while the patient is having his second bath.

For some days a diet is chosen with a view to minimising the amount of excreta, and everything is also done to relieve as far as possible the inevitable mental strain and anxiety, by excluding lachrymose friends and amusing the patient with papers and such like.

On the night before operation the usual aperient is given, and some idea of the habit of the patient must be obtained in order to make the evacuation which is to follow, complete. In the morning a soap and water enema is given, and if possible the night-stool should be used instead of the bed-pan to avoid any accidental soiling of the sheets. Four hours before the time of operation the last food is given in the form of a tumblerful of warm milk, and, lastly, running a sponge over the patient's face and hands a quarter of an hour before he is taken to the theatre, is a pleasant and refreshing finale to his preparation.

Here may be mentioned the value, as a preliminary to many operations, of washing out

the stomach. Of course, when there has been faecal vomiting, it must invariably be carried out; also where the patient is known to suffer usually from post-anæsthetic vomiting, it is often very efficacious as a preventive, and, lastly, where any actual operation is to be done on the stomach, the indication for it is evident.

In the next place the local preparation of the area of operation claims our attention. This is undertaken the night before, after the patient has had his bath. Shaving, if necessary, must be done now, and on no account left until the patient is on the table; after the patient is under it is a waste of time, and if undertaken during anæsthetisation is an injustice to the anæsthetist. The sister, of course, undertakes the shaving of pubic hair in women patients.

Five minutes are first spent in the use of the nail brush, soft soap, and hot water. The fatty matter of the glands and hair follicles is then removed by the application of ether or turpentine. One is as efficient for the purpose as the other, and the supposed germicidal properties of turpentine have been proved of late to be altogether inconsiderable. Next some antiseptic must be used for disinfection;

the actual washing may be done with a strength of solution that could not be left in contact with the skin, and a 1-500 solution of either the perchloride or the biniodide of mercury is suitable for this. Last of all, a wet dressing is applied, which is not to be removed until the actual time of operation arrives. Four layers of surgeons' lint are placed in boiling water for ten minutes. If they are put in when the preparation of the skin is begun they will be ready when they are needed. They are taken out of this and put into the lotion and thoroughly soaked and rinsed in it, then wrung half-dry, and covered with a layer of gutta-percha tissue or mackintosh. After considerable use of the biniodide, the writer has returned to the perchloride as the best lotion for use here, owing to the frequency of the blistering effect of biniodide when left in contact for more than two or three hours. The perchloride lotion is most efficacious as a solution of the strength 1 in 2,000 in ten per cent. methylated spirit, and this may be left in contact with the skin over night without fear of this awkward, though of course aseptic, complication. The dressing should be large enough to

extend widely round the probable area of operation. Where the sole of the foot is to be operated on, and if elsewhere there is sodden and thickened epithelium in the operation area, much advantage is gained by a preliminary use for twelve hours of salicylic acid as an ointment.\* This softens the epithelium so that when the nail brush is used it is readily removed.

These rules form, we believe, as reliable a method of skin disinfection as we at present possess.

The patient's clothing during operation merits considerable attention, and special suits have been designed by some surgeons, such as the linen overall, sterilized, and enveloping the patient from head to foot.

But under ordinary English climatic conditions he requires some other covering than this during an operation of any length, and if blankets, for instance, are used, the special advantages of this suit disappear. Perhaps it is best to rest content with a clean suit of ordinary night gear; thick woollen stockings should cover the legs

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\* The formula for this ointment is :—

R. Ac. Salicyl. gr. xx | Adip. Benzoat. ʒj  
M.

reaching well up over the thighs. In young children the legs and arms are best enveloped in a thick layer of wool retained by a bandage. In abdominal operations of any length, and in all cases where we have reason to anticipate shock, the gamgee tissue jacket, enveloping the thorax, is recommended, in its most useful form, made so that it is fixed by tapes, over one shoulder and down one side.

There is no doubt that the influence of exposure in increasing shock has not been as widely appreciated as it should be; and these coverings have the additional advantage of doing away with the necessity for layers of the clumsy blanket.

#### B.—AFTER OPERATION.

It is universally recognised that the after-treatment determines in no inconsiderable degree the success or comparative failure of all surgical operations.

When the patient leaves the table he has passed through two of the stages of the procedure, but there is a third to come which requires care equally with the others. The anæsthetic and the operation itself have both,



in a greater or less degree, disturbed the natural equilibrium, and our attention is now directed towards its restoration. The patient is carefully carried to his bed after the anæsthetist is satisfied that consciousness is returning, that the conjunctival reflex is restored, and everything else satisfactory. Once in bed his head is kept low, and he is turned on his side unless there is some special reason against the attitude.

A nurse is left to look after him, and every possible means taken to encourage rest. He must not be over-weighted with bed-clothes, and in almost every case a cradle should be used, both to prevent this and to ensure proper ventilation of the bed. The use of the cradle for the latter purpose is not so widely recognised as it might be; the atmosphere under tightly tucked-in bed-clothes, largely, perhaps, consisting of flatus, is not the most desirable for a surgical wound.

In an uncomplicated case no further precautions and instructions than these are necessary, and all fussy interference is to be discountenanced; let the patient alone to sleep.

But complications arise. Before the patient leaves the table a most accurate estimate must

be made of their nature and degree ; then there will be no hurried summons to the ward, and, perhaps, equally hurried treatment of the emergency.

**Shock.**—The most important complication we have to deal with is shock. This occurs in varying degrees. When it is only mild, the number of hot bottles usually placed in the bed is to be increased, and special care taken to keep the head low ; pillows to be dispensed with altogether. The pulse is the most valuable guide as to the degree we have to deal with. Where the tension is markedly low and the respirations feeble, our most valuable remedy is undoubtedly strychnine, administered hypodermically in the form of  $\text{m} \text{v}$  of the *liq. strychninæ*.

In the face of profound shock, however, we must be more energetic. The dose of *liq. strychn.* may with safety be increased up to  $\text{m} \text{x}$ . If the patient be turned on his side, as is best, an enema of two pints of hot water is administered without disturbing him to any extent, and often it has a most marked effect. One has on more than one occasion seen a life plainly rescued by this measure. Brandy may be added to this enema, an ounce to the pint.

A valuable means of indirect stimulation of the heart lies in the application of the Faradic current over the course of the sympathetic; that is to say, by placing one electrode at the nape of the neck and the other over the solar plexus, a marked augmentative effect is produced on the heart's action. Often an additional effect of this application is vomiting, and after this the improvement is usually considerable.

Where the shock arises directly from the amount of blood lost, we must devote our efforts also to the supply of the deficiency. Direct or indirect transfusion of blood has entirely given place to the injection of a bland fluid. This may be either a simple solution of sodium chloride, a drachm to the pint of sterilized water; or a prepared concentrated solution, according to the following formula, may be always kept in readiness and diluted when required. Its sterility must be certain.

R̄	Sod. Chlorid.	5v	Sod. Sulph. āā	5ijss
	Pot. Chlor. grs.	xviiij	Sod. Phosph.	grs. xij
	Sod. Carb.		Aq. Calid.	5vj*

An ounce of this solution to the pint of

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\* These salts must be dissolved in hot distilled water, and afterwards the solution is boiled to sterilize it, and is securely stoppered.

sterilized water is the right proportion. A pint and a-half to two pints are injected slowly by means of a glass syringe; a short length of rubber tubing connects this with the rigid nozzle, which is inserted into the vein chosen.

Heat is the best means of sterilizing this apparatus, and of course carbolic acid must be altogether avoided, owing to its property of coagulating albuminous fluids and therefore blood.

Such a fluid may also be injected subcutaneously into such a loose and abundant cellular tissue as exists between the scapulæ. Unless the circulation is desperately feeble, fluids are rapidly absorbed in profound oligæmia. Owing to this fact, rectal injections also are useful under the circumstances. The rapidity of absorption in either case is nevertheless not to be compared with the direct injection into a vein; hence the latter method is always advisable where the pulse is excessively feeble or imperceptible, and where there are other indications for the immediate restoration of the lost fluid.

**Continued Sickness** is another important but later complication.

Where there is distressing nausea without

vomiting, the latter may be encouraged by draughts of warm water; and after a thorough emesis, not only does the nausea disappear, but food is much better tolerated. Where actual vomiting continues for some hours, an effervescent draught, repeated hourly, is the most valuable remedy; sips of water, as hot as can be tolerated, also sometimes have the desired effect. In the worst cases much the most efficacious plan is to wash out the stomach with an alkaline fluid. The organ is thus entirely emptied, and all adherent mucus is cleared out. Rest and sleep usually follow at once. It may be inadvisable to submit the patient to the unavoidable disturbance of this process; if it seem so, and if ordinary means fail, a mustard leaf over the epigastrium and a hypodermic injection of morphia and atropine combined should be tried. Morphia should not be given alone, as it may only increase the complication. Where the vomiting continues more than twenty-four hours after the operation in abdominal cases, another cause beyond the anæsthetic must be suspected, such as the supervention of peritonitis or paralytic tympanites, and if so, the treatment proper to such complications must be undertaken.

**Diet.**—The question of the diet after operation follows naturally on the consideration of this complication. In ordinary cases no special dietary is called for after the first twenty-four hours. Up to that time, fluid nourishment, in an easily assimilable form, must be given, beginning three or four hours after the recovery from the effects of the anæsthetic. Often, however, there is reason to depart from this simple rule. If sickness continues, all feeding by the mouth must be countermanded and rectal feeding commenced; but as soon as possible a return must be made to the natural channel. What food are we going to begin with? Milk is by no means the best, as a rule, especially in any quantity and in abdominal cases; peptonised milk is unpalatable alone. But peptonised milk flavoured with coffee is a very useful combination. There are also several predigested extracts of meat which have been pronounced chemically and physiologically satisfactory by authorities, and one of these may be used. Small quantities of an alkaline table water are with great advantage given along with them.

For the relief of thirst, fluids given by the mouth should be warm, ice being avoided in

abdominal cases owing to its tendency to cause flatulence. Half-a-pint of warm water as a rectal injection, especially where there is sickness, is to be highly recommended. If the complaint is chiefly that of dryness of the mouth and parching of the lips, an application of equal parts of glycerine and lemon water is very grateful.

**Pain and Restlessness.**—It is very necessary to deal with these two complications, if the patient is to have that sleep which is so desirable. First we must consider whether we can treat them by attention to some local fault. The way in which the dressing has been applied is often the cause of the complaint; the bandage may have been applied too tightly, or the pressure it exerts be unequally distributed, owing to the uneven thickness of the dressing beneath it. Very commonly, too, some small matter in connection with the sutures or the drainage material is at fault; silkworm gut sutures sometimes become entangled in the gauze, and if the dressing be dragged in one direction, owing to their rigidity, they are quite capable of causing enough discomfort to keep the patient awake. Drainage tubing should always be cut flush with the surface.

To take the example of an empyema: if this rule is neglected, the inner end of the tube will press upon a sensitive lung surface when the dressing has been fixed in position, and especially if the patient lie on the wound side, as he will probably wish, and should be encouraged to do. The same rule holds good in the case of all other wounds.

Before administering any general sedative, therefore, we ought to make certain that we cannot give the patient relief by correcting one or other of these small local errors; there is too great a tendency to rush to the former at once, without due examination for the real cause of the pain.

When nothing more can be done for him in this way, unless there happens to be a contra-indication, we must give him some drug. It may be said at once that where there is pain, there is only one that is certain of producing the desired effect, and that is morphia. The two best methods of administering this are by hypodermic injection, and as a suppository. When given hypodermically, the dose should be in the first instance from  $\frac{1}{6}$  gr. to  $\frac{1}{4}$  gr., the suppository should contain  $\frac{1}{3}$  gr. to  $\frac{1}{2}$  gr. It is best not



to give opium in any form by the mouth, and so avoid to a large extent its nauseating tendency; and as the hypodermic administration also not infrequently gives rise to this symptom of nausea, we had best combine with it  $\frac{1}{120}$  gr. of atrop. sulphat., which usually counteracts it. Solutions and tabloids of the two thus combined are easily procurable.

When it is not pain that is keeping the patient awake, but a nervous restlessness alone, the drugs which the writer has found most generally useful are (*a*,) A combination of chloral hydrate and bromide of sodium (grs. x of the former and grs. xx of the latter), or, (*b*,) grs. xx of trional—a near relative to sulphonal, but more rapid and certain in its action.

This restlessness may be exaggerated to the extent of delirium, and in the case of alcoholics, to *delirium tremens*. The patient's management then taxes our resources considerably. We must first take extra precautions to prevent the dislodgment of the dressing during his struggles. He is suffering more or less from shock after the operation, and therefore we must not be too energetic in our administration of sedatives.

The limits to which we should go are 20 grains of chloral hydrate and 30 of sodium bromide every four hours. Doses of opium sufficiently large to be effectual are very often inadmissible in these after-operation cases, and small doses often seem to but increase the delirium. But, except in cases of true *delirium tremens* perhaps, it still remains by far our most trustworthy ally, and the one to fall back upon when others disappoint us. We should be poor without it.

In true *delirium tremens*, it is generally wise to employ some method of mechanical restraint, though opinions differ. It is better, however, that the patient's efforts should be confined to ineffectual attempts to get out of bed, than that he should spend the night fighting with the attendants on the ward floor. It must be employed with as little violence as possible, and the circumstances of the case will suggest the best method. If a folded sheet be tightly secured round his chest at the nipples, and his hands be brought out over this and prevented from pulling at it, he soon finds, as a rule, like the ox that kicks against the pricks, that he is wasting energy. Very often he can be induced to drink fluids

if persuasion be used judiciously, but some of the worst patients will require feeding through a tube passed into the œsophagus by the nose, and six to eight ounces of fluid can be given in this way every three or four hours.

This amount must be maintained as far as possible. If his heart shews signs of failure in spite of it, digitalin should be given hypodermically, gr.  $\frac{1}{100}$  at a time, and repeated as necessary. The amounts of stimulant and sedative are regulated by the degrees of excitement, exhaustion, and shock, in each case.

Thus far we have considered the ordinary management of operation cases and the more general complaints and complications that arise. Many operations require a special line of treatment, and this will be considered under the heading of "Special Cases."

*IV.***THE OPERATING THEATRE  
AND THE OPERATION.**

THE theatre is the sanctum and shrine of the hospital, and every detail of its arrangement and ritual calls for careful thought. It should be in the responsible charge of one nurse, who has nothing to do with ward work; it is plain that hands that come in contact with bed-pans and such like utensils should not touch instruments. In the first place, let it be observed that dust is a most important germ-carrier, therefore surfaces which may harbour this should not be admitted into the architecture of a theatre; shelves and ledges should be banished as far as possible to the ante-room; chandeliers are altogether inadmissible—a surgeon who operates under a chandelier, and perhaps turns it during the operation, probably brings down quite a shower of microbes on his patient. Most modern theatres are so constructed that a hose can be turned on to walls and

floors as often as is needful. If this cannot be done, they should, as a matter of routine, be washed down once a week, and as often at other times as occasion requires. Dusting of course must be done daily, and sufficiently early to allow any that remains to settle before the theatre is made use of.

With regard to furniture, portability and facility in cleaning are the chief desiderata. Lotion, instrument, and dressing tables, should therefore be on castors, their framework of metal, and their shelves of glass. These must all be scrubbed with a brush and 1-20 carbolic, after each time the theatre is used. The mechanical scrubbing is what is really important—a simple wiping down with carbolic is useless. The minimum amount of furniture that is required is an operating table, an instrument table, a lotion and dressing table, and an anæsthetist's table. Generally these will suffice for ordinary operations, but an accessory instrument table is sometimes needful.

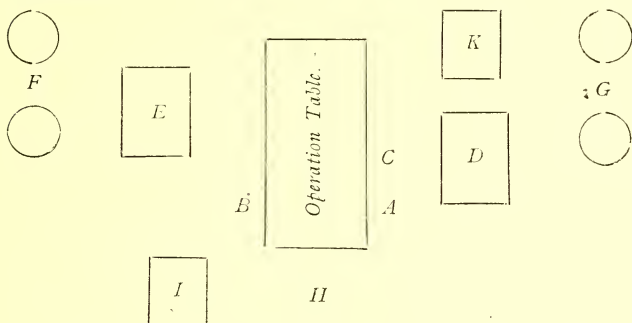
The best operating tables are also those made of metal, and on wheels which can be thrown out of gear, so as to allow them to stand on firm legs while the operation is going on.

Every table should be provided with mechanism for raising the shoulders and the lower limbs. If it does not possess this, apparatus in the form of a framework for raising the pelvis and lower limbs at least, is easily clamped on. The tables which have hot-water tanks lose slightly in portability, but gain very much from the point of view of the patient, and are most certainly a step in the right direction.

Adjoining the theatre is the anæsthetizing room, where the patient is "got under," and so not called upon to face the various preparations for operation, and, it may be, students in the theatre itself. This plan makes wheels on the table to be absolutely necessary. To lift a patient about from one table to another while under the anæsthetic is a most reprehensible habit, and several deaths under chloroform have apparently been due to roughness during this process.

A convenient arrangement for the theatre is shown in the accompanying diagram (*see opposite page*). The surgeon stands to the right of the table; opposite to him the chief assistant; to his right the second assistant. The instruments stand ready to his hand; and of course if he

stand to the left the whole arrangement is reversed.



*A*, Surgeon. *B*, Chief Assistant. *C*, Second Assistant. *D*, Instrument Table. *E*, Dressings Table. *F*, Basins for Sponges. *G*, Basins for Surgeon and Assistants. *H*, Anæsthetist. *I*, Anæsthetist's Table *K*, Accessory Instrument Table.

To the left hand of the chief assistant are the lotions and dressings, and behind this the basins where sponges are rinsed and washed. To the extreme right are the basins where surgeon and assistants have prepared their hands.

The anæsthetist is at the head of the table, and his own table stands on his left; on this should be a stock bottle of the anæsthetic in use, a pair of tongue forceps, a gag, a hypodermic syringe with the necessary drug or drugs, and, under exceptional circumstances, the apparatus for intravenous saline injection.

It is very necessary that everyone on the floor of the theatre should have an exact knowledge of what is expected of him or her, so that everything may be done in order and without haste; then if an emergency arise, no one loses his head, and the right person deals with it at once. It cannot be too much impressed on nurses that each has her own definite work, that, for instance, one who removes a dressing gown or slippers, or picks up an instrument off the floor, must not have the remotest indirect communication with the operation wound. Of course it is needless to remark that assistants and nurses who are to take any active part in the technique during operation, must sterilize their hands after a reliable method, such as one of those mentioned under the head of "Personal Asepsis." Spectators around should be discouraged; if they are unavoidable they should be provided for at a distance from the vicinity of the operation.

The general plan of an operation is as follows: First, it is left to the anæsthetist to signal the time for commencement; neglect of this rule usually leads to waste of time in the end, and the surgeon who does so, cannot blame the



anæsthetist for any eventuality that may arise from it. The operation area is then uncovered and surrounded according to habit with mackintoshes, and soaked towels. These are best prepared by five minutes' boiling before use, and they may then be either left simply aseptic, or immersed in lotion before being placed in position. At the sides sponge-cloths are packed, to absorb any blood or other fluid, and in this way the patient is kept dry underneath; nothing that is not sterile should be within reach of the operator's fingers, and all corners of blankets, night-dresses, etc., are well hidden away under the coverings in use. The operator then proceeds. The instruments being all within reach he takes them out of the trays himself, and avoids introducing another pair of hands to pass them to him; if he arrange them beforehand this habit need involve no extra time. He also avoids leaving them lying about on the towels, otherwise they are liable to find their way to the floor.

His assistants should endeavour to find a mean between the officiousness that always has a suggestion ready, and the lifelessness that never anticipates a want. The chief assistant has charge

of pressure forceps and retractors, and of the sponges and swabs; these latter he should take out of the lotion bowl himself, and not have them squeezed out by another individual.

A roll of absorbent wool taken out of a packet and placed in a bowl of antiseptic lotion is not a reliable swab; if sponges are not used, the alternative should be wads of wool surrounded with gauze, which is retained by a stitch; and these are to be boiled and stored in glass jars, in the way sponges are kept. The second assistant may or may not be necessary, to hold retractors, steady limbs, manipulate parts of instruments, or perform other minor duties.

All conversation is best reduced to a minimum, and a surgeon who finds it necessary to ask the advice and suggestions of colleagues during the course of the operation, unless for exceptional reasons, had much better resign the whole proceeding to them. The time for consultation, if there is need for one, is before and not during the operation—the time for discussion and speculation comes after. A surgeon who keeps up a running criticism on his procedure for the benefit of those around, forgets that he should have in his mind the interest of one

individual alone—his patient—and that no one else has, for the time being, any claim on his attention.

After the completion of the operation the dressing is applied, carefully and without loitering, while arrangements are at once made for conveying the patient back to bed. Once there, he enters upon the chapter of after-treatment.

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## V.

**SPECIAL CASES.**

**Operations on the Brain.**—Cases of Jacksonian epilepsy, and those with other chronic complaints, are usually kept under observation for some time previous to operation, in order that their symptoms may be carefully studied and lesions accurately diagnosed. They should, as a rule, remain in bed, and an accurate daily record be kept of all that throws light on their disease. Their diet should be low. The examination of the head must be very thorough, and it is convenient after mapping out the points of importance on the skull, if the one or two which will be used as guides in the operation be marked in permanently with a silver nitrate pencil.

Traumatic cases are the commoner subjects of trephining. When a patient is admitted into hospital with symptoms of cerebral hæmorrhage and compression, time is of very great importance. Preparations for operation must be made at once. The house surgeon must use all his intelligence to localize the source of hæmorrhage and, the earlier

signs and symptoms are by far the most important. Of course, where the case is one of depressed fracture there is a direct guide; but cases of middle meningeal hæmorrhage are not always easy to clear up when the increase of cerebral pressure has become general; therefore, note all the symptoms carefully, immediately on admission, and get a history from friends of the time and nature of the injury.

In these cases the preparation of the scalp will have to be done rapidly; the skin is prepared in the usual way after the hair has been shaved. In all cases it is best to shave the whole scalp. Morphia, gr.  $\frac{1}{4}$ , is given hypodermically before the patient is put on to the table, and chloroform is the anæsthetic chosen. A firm sand-pillow supports the head at a convenient angle. In epileptic cases a Faradic current and suitable electrodes should be available.

After all operations on the brain special effort must be made to ensure complete rest to the patient; the room should be darkened and all noise forbidden. The head must be slightly raised on a pillow. If restlessness is marked after recovery from the anæsthetic, a small dose of morphia is to be given to control it. If a

drainage tube has been used, it is removed after twelve hours. Complaint of a feeling of tension and throbbing after this, with a rise of temperature, means in all probability that suppuration has taken place under the flap, and no time must be lost, when the symptoms are definite, in raising it and allowing the discharge free escape. A later complication is hernia cerebri. To attempt to keep this down by pressure is irrational, seeing that it is an evidence of morbid tension within the skull. The cause must be sought and attacked, and the commonest is septic inflammation.

One of the commonest operations on the head is that for mastoid suppuration, and this again is the most frequent cause of metastatic cerebral abscess. The usual clinical history of such an abscess is as follows: First, it may be after operation, the patient complains of persistent headache, and is drowsy; the temperature sinks slowly, and next vomiting commences. The headache is localized. Then comes a rigor and a rapid rise of temperature. The absence of optic neuritis is no guide. Localizing signs must be carefully looked for; they are those of pressure chiefly, but the cerebellar symptoms are distinguishing. Operation is

urgently called for once the presence of the abscess has been diagnosed.

After all cerebral operations, under the most favourable circumstances, the patient should not be allowed to sit up or make any considerable exertion for a week, and not to get out of bed for at least a fortnight. The excretory functions must during this time be regulated with great care, any tendency to constipation being treated with calomel and a saline.

**Operations involving the Mouth and Pharynx.—**

Mechanical methods are chiefly to be relied upon in preparing these cavities. The aid of the dentist must be enlisted, decayed stumps all cleared out, and the teeth scaled. As soon as admitted, the patient begins using a mouth wash of 1-60 carbolic acid. The use of the tooth brush is to be entrusted to a nurse, not to the patient himself, as it may very likely be his first acquaintance with the instrument. These attempts to render the mouth surgically clean are well rewarded. The patient should always be clean shaven. At the operation the only special point of technique beyond the actual steps of the operation itself is the giving of the anæsthetic. Chloroform is to be given either

through the nose-piece of a Junker's apparatus or by means of Hewitt's gag attached to this same apparatus, and the anæsthetist requires a good deal of dexterity to keep out of the operator's way.

There is usually a raw surface of considerable size left, which may or may not communicate with both mouth and an external wound. If with the mouth alone, as in a Whitehead's excision of the tongue, firstly, the wound is to be kept clean, and secondly, discharges must be encouraged to escape. The mouth is frequently washed out, and for this purpose carbolic acid (1-80), creolin, sanitas, and izal, are suitable lotions. This frequent washing must be continued until the wound surface shows healthy and healing granulations. After each rinsing, the raw surface must be rubbed dry and iodoform powder insufflated on to it.

Opinions differ as to the use of a plug of gauze in these cases ; on the whole the weight of evidence is in its favour. If used, iodoform gauze is the best, and the plug must be renewed after each rinsing of the mouth. To encourage free escape of the discharge, the patient must be propped up in the sitting posture as soon as possible, and be instructed to expectorate all saliva and discharge



into his spittoon. For the first forty-eight hours at least he will require the undivided attentions of a nurse.

The treatment of cases of excision of the superior maxilla is similar to the above, the external wound being closed. Here the iodoform gauze plug is always to be used.

Where, as in case of excision of the larynx or in Kocher's excision of the tongue, there is an extensive and dependent external wound, drainage is necessary between the oral cavity and the surface of the wound for fear septic discharges should find their way into the cellular tissue of the neck. A drainage tube is preferable to gauze. It must be of large size, and when the wound is dressed it is removed and cleaned, but cannot safely be left out earlier than the eighth day.

The feeding of these patients is of great importance. In a case of tongue excision, rectal feeding may be employed for the first twenty-four hours, and at the end of this the patient will probably be able to swallow fluid from a feeder. After excision of the upper jaw an œsophageal tube will require passing for some three or four days; after that the power of swallowing is to be encouraged, the mouth carefully cleansed,

and the plug renewed after each meal. In the still more extensive operations involving the pharynx, the œsophageal tube must be left in place for the first few days, and after that passed when necessary. Nutrient enemata are to be given at the same time, as these patients require as much support as possible. Attempts at swallowing should be made at the end of a week, with the head hanging over the edge of the bed and the wound uppermost; but the period after which patients regain this power is very variable.

One of the chief dangers to be feared in all these cases is septic broncho-pneumonia. It usually appears about the fourth day and onwards. The temperature mounts gradually, and the characteristic physical signs appear in the chest. Nearly always it is the patient's death warrant. Since energetic measures have been employed to keep the wound cavity and mouth clean, however, it has been much less frequent.

**Tracheotomy.**—This is an operation which not infrequently falls to the lot of a house surgeon to perform, but to describe the actual steps of the operation does not form part of the writer's design. There is often so much confusion about its performance that a good rule to follow is to do it as

deliberately as possible under the circumstances. Chloroform is administered in the usual attitude, and very often quite a small amount only is necessary. When the patient is under, a small, firm pillow is placed under the nape of the neck and the head fully extended. Three useful rules may be mentioned : Stop all hæmorrhage as the operation proceeds by twisting the vessels ; make sure you see the rings of the trachea distinctly ; and, do not remove the sharp hook until the tube is safely home. The writer once had the privilege of witnessing artificial respiration done on a patient whose tube was carefully inserted between layers of cervical fascia. Before the patient leaves the table one should make certain the tube is secured beyond all possibility of its slipping out.

The atmosphere of the room in which the patient is confined must be maintained at a temperature not lower than 65° F. In most cases, and especially where we have to deal with an exhausted child, the steam tent is much better dispensed with, and the respired air kept moist by placing a sponge wrung out of warm boro-glyceride\* lotion over the tube. If,

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\* A solution of boro-glyceride, ʒss to the pint of sterilized water.

however, the tracheal secretion is very tenacious and sticky, the tent should be used for a time. The inner tube is removed hourly or thereabouts at first, and all mucus cleared out by syringing with an alkaline and antiseptic solution, such as boro-glyceride. Selected feathers are used by the nurse from time to time to remove any plug of mucus partially blocking the inner tube; but one often sees them used unnecessarily, and they are only called for when the signs of obstruction are plain. Another valuable means of facilitating the removal of sticky mucus, is the use of the spray, either a steam or hand spray, and preferably the latter. This is made to play over the mouth of the tube from time to time, for five or ten minutes. Boro-glyceride solution is here again excellent, or a simple alkaline solution (bicarbonate of soda, grs. xx to the 5j) may be used. The tube must be removed entirely as soon as possible, and in cases where the operation has been for diphtheria or œdema glottidis, this is usually about the sixth day. Unfortunately the entire removal has often to be delayed much longer, but it is at least possible to substitute a rubber for the metal tube at this time. When the tube is first

taken out, the surgeon must be prepared with a pair of dilating forceps for the wound, as not infrequently sudden dyspnœa comes on, followed by syncope.

Feeding is at first best carried out in children through a soft rubber catheter, passed into the pharynx through the nose; through this, fluid nourishment is to be given every two or three hours. Tact and gentle persuasion, judgment and readiness for emergencies, are all demanded in the after-treatment of these cases, and at the same time the personal supervision of the surgeon himself at every stage.

**Empyema.**—No special preparation is necessary for a patient to be operated on for empyema. It is a wise rule to find pus with an exploring syringe, on the table, before opening the pleura. During the operation there must be no turning of the patient completely over on to the sound side; more than one case so treated has died from sudden syncope. The anæsthetist must watch respiration very carefully.

Surgical after-treatment concerns only those cases where thoracotomy has been performed, and a drainage tube inserted. Every consideration is secondary to that of maintaining efficient

drainage. In an ordinary case in a child, if this be kept in mind, the progress towards recovery will usually be uneventful. Various tubes are in use with a supposed valvular action during respiration, but it is doubtful if any such are necessary, and several interfere with the easy escape of discharge. The simplest form of tube is made by splitting one end of an ordinary red rubber drainage tube into four, passing these through the centre of a piece of rubber about four inches square, and sewing them down on its surface in the four directions in which they naturally lie. This tube is taken out daily, or more often, and cleaned; it is to be kept of the same calibre, but to be shortened as the wound closes. It can usually be removed entirely about the tenth day.

It is in cases of adults, chiefly, that there are departures from this simple history. The pus is more frequently bad smelling, and the infection more virulent. Adhesions form pockets that are difficult to drain, and the wall being more rigid, and the power of expansion of the lung less active, the wound is sometimes slow to heal. Here again the maintenance of efficient drainage is the point of greatest importance;

the tube must be kept of large size, and the process of shortening proceeded with slowly.

Is the cavity to be irrigated? This is by no means a proceeding without risk; even in very old-standing cases death from syncope has occurred during the process, especially if the empyema be left-sided. If it is employed, and there is no doubt of its value apart from its danger, especially in very offensive cases, great care must be taken that there is the freest possible escape for the fluid.\*

Patients must be encouraged to lie on the wound side, and in fact they usually prefer to do so.

On the third or fourth day after operation, if the temperature remain down, the patient should be got out of bed for half an hour. Gentle exercise is added to this in another couple of days, and in favourable cases the healing process is often complete about the ninth day. During the whole of convalescence a liberal diet is called for.

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\* Lotions of value are :—

(1,) R Tinct. Iodi. ʒj; Aq. Calid. Oj; M.  
(2,) Izal  
(3,) Sterilized water.

**Abdominal Section.**—The ordinary routine preparation for a serious operation may need some variation, according to the patient's condition as to collapse, and according to the organ on which the operation is to be performed. The bladder is to be emptied before the patient is put on the table. Chloroform is to be preferred to ether as the anæsthetic; one of the chief reasons being that the cough, not infrequently excited by the latter, is very much to be feared both during the operation and after.

When the patient is back in bed, there are several important questions to keep in mind. The ordinary complications, shock, sickness, etc., are to be treated as indicated in a previous essay.

In the first place the bladder and intestines must be watched for any distension, and if it occur, the catheter is used in the one case and the flatus tube in the other. The latter may be worn for a quarter of an hour or more at a time, and often enables the patient to pass much flatus which he is otherwise quite unable to get rid of.

No food must be given, at least by the mouth, for twenty-four hours; at the end of this time peptonised milk flavoured with coffee



and hydrochloric beef juice are suitable foods to administer in small quantities.

Thirst is to be allayed by a rectal injection of half-a-pint of warm water; but after six hours or so, if there is no sickness, warm water may be given in sips by the mouth; no ice and no soda water on any account.

The two complications to be feared are hæmorrhage and peritonitis. Hæmorrhage is to be looked for within the first twenty-four hours. The drainage tube will enlighten us, if there is one in use, and its mouth should be covered with a light dressing only, in order that we may be aware of its occurrence as soon as possible. The temperature and pulse must be registered every two hours, and if hæmorrhage is occurring, the former will fall gradually more and more subnormal, and the latter (the pulse) will increase in rapidity and decrease in volume. If we have these two symptoms in the first twenty-four hours, a subnormal temperature and a small, rapid pulse, we may diagnose hæmorrhage with certainty. Of course, it must be dealt with at once.

Peritonitis comes on usually at the end of the third, or on the fourth day. The temperature chart is no guide to its occurrence. The

two symptoms of real value are the rapid pulse (its quality is not the point of most importance), and the rigid abdominal wall. With these two symptoms present we may with confidence diagnose the supervention of peritonitis, and take suitable measures according to the case.

**Intestinal Obstruction.**—Supposing a case has been sent into the hospital, the first duty is to get an accurate history from the patient himself and his friends, as to the period of the commencement of the symptoms, vomiting and total obstruction. Then examine him for hernia, and if none is found make a digital examination of the rectum. There is something indescribable in the patient's aspect which one soon learns to trust as an indication of the seriousness of the case. If there is a hernia, as a rule attempt to reduce it by taxis for some minutes. If this is impossible, or there is no hernia but signs of internal obstruction, and if fæcal obstruction simply can be pretty confidently excluded, then prepare the patient for an anæsthetic at once. If there has been fæcal vomiting, wash out the stomach. One does not at first realize the immense importance of time in such a case as a strangulated hernia; one is in-

clined to temporise a little, and learns the value of an hour sometimes at the patient's expense.

There are cases of strangulated hernia on whom taxis is not to be attempted. Where, as one often finds, the symptoms have developed rapidly and been bad from the first, where there has been local pain, and where the pulse is rapid and the patient's aspect that which one associates with peritonitis—where, in fact, everything points to serious damage to the gut, here taxis must be avoided and operation hastened. Where the symptoms are not of particular gravity, where in fact the condition more nearly approaches one of incarceration than of strangulation, taxis may be persevered in for a time; first on the bed, then in a warm bath, and lastly under an anæsthetic. If an anæsthetic is given, however, everything must at the same time be made ready for the possible operation. There is every degree of case between the one in which one would not dream of handling the gut with pressure, and the one where one feels sure that taxis may be undertaken perseveringly for a considerable time if necessary. One must be guided by the severity of the symptoms and the period during which they have existed, and by the

aspect of the patient before alluded to. Rectal examination, when hernia has been excluded, is for the diagnosis of two possible causes, intussusception and rectal obstruction from new growth, etc.

Very often there are no definite physical signs to guide us; we only know that there is obstruction, and the diagnosis of the exact cause is only made after abdominal section.

Presuming that the obstruction has been relieved, and that any excessive flatulence has been removed by enterotomy at the time of operation, what after-treatment is called for in these cases? We watch anxiously for the signs of the passage of flatus into the rectum, and if these appear then all is well; if no flatus passes and distension increases, then enterotomy is probably called for. But first, however, the effect of wearing the rectal tube should be tried, and also purgative enemata administered in the hope of stimulating peristalsis and emptying the over-distended bowels. If enterotomy is undertaken, it is done, of course, without an anæsthetic, and the first coil of distended bowel which presents itself at the reopened wound is chosen for the purpose.

Feeding must, at least for the first forty-eight hours, be entirely rectal. The nutrient enemata are given every four hours, and consist of five ounces of peptonised milk, and half an ounce of whiskey; meat peptones may be added to this.

In the most favourable cases, predigested foods may be given by the mouth at the end of the second day; but if continued, though not excessive, distension shows that the bowel has not yet recovered tone, they must be withheld longer. Opium is to be avoided; the more we learn of the symptoms that are most to be dreaded in these cases, the more evident is it that opium is physiologically capable of producing them. The question of the use of cathartics is not so easily dismissed, and one can speak definitely in the negative only; that is to say, they should never be given unless it be certain that the obstruction is entirely removed. Discussion on this matter has been very extensive. Of late the use of purgatives seems to be received with more favour; success depends on the re-establishment of peristalsis and the increase of intestinal secretion, both of which cathartics induce, always provided that obstruction is entirely relieved. If this be certain, intra-intestinal injection at the

time of operation is a convenient and satisfactory means of administration.\*

**Colotomy.**—There is no special preparation for a case of colotomy. Until the anus is satisfactorily formed, and the patient can wear a permanent belt, the wound requires much attention. Once the bowel is opened, excoriation of the surrounding skin is to be guarded against. Over the opening, layers of carbolised tow form the best dressing, and the most important point of all is, that this should be changed as often as soiled. The skin is smeared with an iodoform ointment, renewed whenever the dressing is changed; and to carry out these duties a special nurse will be required for some time. The small opening may have to be enlarged for the passage of scybalous masses; this is best done with laminaria tents, and the masses extracted with Lund's forceps. The use of Paul's tubes obviates the dangers of excoriation of the surrounding skin, as the excreta pass away into dressings which can be used to shut off the wound. When there are scybala to be dealt with, they are very difficult to manage.

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\*A saturated solution of  $\frac{3}{4}$  of magnes. sulphat. is injected into the ileum by a syringe and needle, and the small puncture closed by a single Lembert's suture.

Now that more attention is given to the formation of a good "spur," the accumulation of fæces below the artificial anus does not so frequently give rise to trouble; washing out the lower bowel, either from above or below, is the best way of removing any such collection. When the wound is healed, an endeavour should be made to obtain a satisfactory motion every morning, by taking a dose of sulphate of magnesia on rising. During the day a belt is worn encircling the abdomen, and with a perineal strap; this keeps in position over the anus either a simple dressing of absorbent material, or some one of the various plugs and receptacles which have been devised for the purpose. If prolapse of the bowel occur, the belt must be provided with a special pad for its support.

**Suprapubic Cystotomy.**—If the bladder be irritable, if there be residual urine, or if for other reasons the urine be ammoniacal, the bladder should be washed out twice daily for some days before the operation, and the unhealthy condition overcome as far as possible. For an ordinary case of stone in a child it is quite unnecessary, but this is not the operation of choice in such a case. The ordinary preparation of the rectum,

and of the skin, is carried out, and the pubes shaved.

When the patient has been anæsthetised, the bladder is filled with a 2 per cent. solution of boracic acid at a temperature of 100° F. In amount this varies from three ounces in a child of three or thereabouts, to about twelve ounces in the adult. It is injected from an irrigator. If the base of the bladder is to be operated upon, as, for instance, in a case of prostatectomy, the rectal bag is also to be used. In that case the bag is introduced first into the hollow of the sacrum, then the bladder is filled as above, and, lastly, warm water to a maximum of ten ounces is passed into the bag. The operation is then proceeded with.

In many cases, such as where suprapubic cystotomy is performed simply for the removal of stone, primary suture of the bladder wall is the proper treatment. The only question of after-treatment is that of the use of the catheter, and in simple uncomplicated cases it appears to be quite unnecessary, and the patient may be safely left to evacuate his urine himself, any over-distention of the bladder being very carefully guarded against.

In other cases we have no choice but to drain



the bladder through the suprapubic wound—for example, where the urine is unhealthy, where there is cystitis, or where there is incapacity to evacuate it completely.

When this is so, by far the most satisfactory dressings are sponges wrung out of carbolic lotion and frequently changed, it may be every quarter of an hour or so. The skin around the opening is smeared with iodoform ointment, or may be covered with a layer of iodoform and collodion. No drainage tubes are necessary, as the intra-abdominal pressure will keep the bladder empty. Daily irrigation is only necessary when the urine is ammoniacal, or the mucous membrane inflamed or ulcerated. Gradually the opening closes, but it usually takes some three weeks before this is complete.

**Perineal Lithotomy.**—Special preparation only concerns the amelioration of any unhealthy condition of bladder wall, or urine, which may be present. Care should be taken that the rectum is absolutely empty before the patient is put on the table; so pass a rectal tube half an hour beforehand. After the operation the patient lies on his back on a firm mattress, and his knees are supported by a pillow on each side. As one of the early dangers is

suppression of urine, opium should not be given. Every effort must be made to keep him dry, and the only hope of this lies in the very frequent changing of the dressing and draw sheet. Large sponges form the most convenient dressing; about a dozen are required, and when saturated each is removed, first rinsed in water, and then allowed to stand in 1-40 carbolic for some half-hour. They can be conveniently dried before the ward fire, and are then ready for use again.

The tube must be kept patent, and clots often require removal with a long-handled pair of dressing forceps. Usually the tube may be left out altogether at the end of forty-eight hours, but this will depend on the condition of the urine; if this is phosphatic and ammoniacal, or if there is any bleeding still going on, it cannot be discarded. In the former case, irrigation of the bladder is called for three or four times daily, and the tube is retained until the fourth or fifth day. The perineal wound is now allowed to heal spontaneously, and the process is usually complete in about five weeks. The after-treatment of cases of perineal section for stricture is similar to the above, except that instead of the lithotomy tube we have to deal with a

catheter. This is passed, at the time of operation, through the whole length of the urethra into the bladder. It is to be retained as long as possible. If the bladder does not resent it, if the urine remains healthy, there is then no necessity to remove it for five or six days. After its removal, the channel is kept patent by passing a No. 12 bougie every second day, and if this is done the perineal wound heals readily.

**Vaginal Hysterectomy.**—The patient is allowed only liquid nourishment for three days beforehand. Supposing the operation has been fixed for July 10th, on the night of July 8th an aperient is given, followed on the morning of the 9th by a simple enema. On the 9th, the pubes and labia are shaved and washed with soap and water and turpentine. The vagina is distended with a Sims' speculum and swabbed out with warm soda solution (5j to Oj); then a copious douche of 1-4000 perchloride of mercury given, and this is best done in the lithotomy position. On the night of the 9th the vagina is plugged with lint soaked in 1-4000 sublimate lotion, and a large compress of the same is applied over the vulva, covered with gutta-percha tissue, and retained by a T bandage.

On the morning of the 10th, a simple enema is

given. An hour or so after, the rectal catheter is introduced, and left *in situ* for fifteen minutes. Then the plugs are removed from the vagina and the cavity douched out with two pints only of perchloride lotion (1-4000). The dressing over the vulva is renewed, and lastly, immediately before the patient is put on the table, the bladder is emptied by a catheter.

When the patient is brought back to bed, her head is kept low, and her knees flexed over a bolster and tied together. After eight hours the catheter must be passed. The pulse and the perinæum are to be watched for hæmorrhage; the temperature and pulse are charted every two hours for the first twenty-four, and after that four-hourly. The bladder and intestines are to be watched for any distension, and it is well to empty the former every eight hours for the first three days. Forty-eight hours after operation the central clamps (a narrow-bladed pair of forceps placed on the distal side of the large clamps) are removed; the blades are fully separated and carefully rocked to and fro in an antero-posterior direction; no traction must be employed. Seventy-two hours after operation the large clamps are removed in like manner. Twelve hours after this the iodoform

plug is removed from the vagina and a douche of warm boracic lotion given, and the vagina loosely replugged again. In two days this plug is removed entirely, and vaginal douches are commenced and continued for three weeks, twice daily. At the end of this time the patient sits up in bed, and at the end of the fourth week is allowed out of it.

**Rectal Operations.**—When the rectum is to be dealt with it is advisable to keep the patient on a diet of peptonised foods for some three days before operation. On the first of these a purge is given, followed in due course by an enema; on the second, a soap and water enema is given night and morning; on the third, rectal lavage is to be carried out through a large double-channelled tube with warm boric acid solution to the extent of four or five pints. After this an iodoform bougie is to be inserted. It is best not to give an enema on the morning of operation; if one has been given the rectal tube must be passed before the patient is brought to the theatre to make certain that none remains. The night before operation the anus and parts around are shaved and scrubbed with green soap and turpentine.

Where the operation is merely the incision of a fissure, or some such small matter, all this prepara-

tion is hardly necessary, but where an operation for internal hæmorrhoids, for instance, or other similar proceeding is to be undertaken, we must make every effort to render the passage as clean as possible.

The after-treatment of a case of hæmorrhoids is as follows : Before the patient leaves the table a suppository of morphia and cocaine is inserted ; a pad of iodoform gauze and absorbent wool, kept in position by a T bandage is all the dressing that is required. Neither in these nor any other rectal cases does the passage itself require plugging, and it is a cruelly painful proceeding. Opium will probably be required again at night in small quantity, and a hot fomentation to the perinæum will be comforting to the patient and assist in procuring sleep ; but if the sphincter has been properly dilated on the table the pain will probably be small. The bladder must be watched carefully, as retention of urine is one of the most frequent complications. The patient is put on a milk diet varied, if it is very irksome, by meat extracts, cocoa, and other fluid foods, and until he has had a free motion no solids must be given. On the morning of the fifth day an aperient should be given by the mouth (castor oil is as good as any) and if

necessary the evacuation may be assisted by an enema of ʒij of glycerine. He must not be allowed to consider himself well too soon; in most cases three weeks are required for convalescence.

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*VI.***THE WARDS.**

IN any large surgical ward we have a great variety of patients and wounds collected together, and their proper arrangement needs a good deal of care. It is certainly best to, if possible, keep operation cases separate from those who either have no open wounds, or whose wounds are contaminated. If, for instance, we have a choice of two wards, in one we should collect all the former, and this should be on the same floor as the theatre, and in the other, fractures and dislocations, most urinary and rectal cases, and those with septic wounds. The latter must be still further sorted out: cases of gangrene, of extensive cellulitis or erysipelas, and others, where the infection is very virulent, must go to a "separation ward"; and it is much to be preferred that the charge of these should be in the hands of someone who will have nothing whatever to do directly with those in the other wards.

These principles of separation are more or



less carried out everywhere in these days, but perhaps not sufficiently thoroughly, and the accommodation for the isolation of septic cases is in most hospitals very limited.

If we must have septic and clean cases within the same four walls, we can at least arrange the beds. A colotomy, for instance, should be as far away as possible from a breast amputation, a septic empyema from an abdominal section, and so on. So also it is best to separate up the nursing duties in such a way that the hands that minister to the one class have as little as possible to do with the other. This process must also be extended to the instruments and other apparatus used in dressing. In some few hospitals it is possible to remove the aseptic cases one by one to a dressing-room opening out of the ward. Here everything is looked after as carefully and kept as scrupulously clean as in the operating theatre, and the dressing is done under the same conditions as the operation. Theoretically this is the most perfect plan, but practically at the present day it is hardly worth discussing. In the first place, it is often inadvisable to submit the patient to the exertion necessary to the removal ; secondly,

if it were widely adopted, the number of house surgeons in our hospitals would have to be doubled; and lastly, the necessary accommodation is rarely available.

Occasionally it may be wise to dress a case in this way in the operating theatre. For instance, if such a case as an erosion of the knee or a psoas abscess happened to be unavoidably placed in a ward with dangerously septic cases, the great danger of infection would suggest some such method of avoiding it.

Of course, under no circumstances are any but clean cases to be thus dressed in the theatre, and on the whole the dangers of our ward system are not so great that vigilance and adherence to principle cannot overcome and nullify them.

Before commencing his ward visit proper, the surgeon or house surgeon should form some definite plan of the order in which he intends to do his dressings. By consulting the sister's report book and his own memory, he will know which cases require re-dressing and which may be left over.

Of the former he takes first the aseptic, or those presumed to be aseptic. The indica-

tions for the re-dressing of such a wound are firstly, the removal of any material inserted for drainage purposes, usually on the day after operation ; secondly, the removal of stitches, usually about the end of the first week ; and thirdly, some complication such as the slipping of the dressing or a rise of temperature, which seems to indicate retention of discharge, or some complaint of discomfort from the patient. The rise of temperature may mean not only the retention of discharge but that it is septic, and this is to be judged from the height of the thermometer, the sensations and general aspect of the patient, and the period when the rise occurred. If it is judged due to sepsis, the case is left till later. While dressing, the surgeon should either be in his shirt sleeves, or, better still, wear some such garment as the jaconette overall mentioned in a previous essay. His hands must be rendered surgically clean by some reliable method. The few instruments that he will require may be kept in a tray containing a 1-40 solution of carbolic acid, during his round. They are afterwards re-sterilized in boiling soda solution. Mackintoshes must also be prepared ; those which have been used only

at operations or previous aseptic dressings must be used here, and each one should be marked and known. After use they are best cleaned in the following way: First remove all blood-stains with tow, then scrub them with brush and soap in the bath, and lastly rub them down well with 1-20 carbolic acid. The lotions in use will vary according to choice. It is convenient to have one that can be put to many different uses, rather than a particular one for each of the different purposes. In this light the biniodide of mercury has advantages over many, and izal is also almost universal in its applicability.

The most convenient lotion bowls are of porcelain, with a measurement scale stamped on the inside. The proportions of lotions can then be accurately judged, and not left to guess work. All lotions must be diluted with sterilized water only. This is prepared a clear half-hour before the visit, so that it may be of the right temperature. It is brought into the ward in jugs, preferably of porcelain; those of enamelled iron have a way of getting "furred" which is objectionable.

A dressing cart is necessary for the purpose

of conveying all these implements from case to case. It is best made as simple as possible, with few corners and crevices to collect the dust. An upper flat surface of glass and an under shelf of the same, in a wooden framework, form a convenient pattern; and a drawer may be inserted under the upper tier.

The legs should be long; most of the present patterns are absurdly low, and the under-shelf very awkward to get at. On this cart we must have everything that may be required during the round, and then no rushing out of the ward for this, that, or the other thing will be necessary. The following list includes what will probably be required, but of course this will vary according to taste and custom:—

Prepared Dressings in box	Spread Ointment in box
Mackintoshes	Kidney Trays
Receivers (2)	Ligatures and Sutures in carbolic (1-20)
Spirit Lamp	Insufflators and Dredgers containing Powders
Lotion Bowls	Syringes
Sponges or Swabs	Turpentine
Lotions in W.Q. bottles	Glycerine
Jug of Sterilized Water	Antiseptic Lubricant.
Drainage Tubes in solution	
Irrigator	
Irrigator Nozzles for the different patients	

In the drawer :—

Bandages	Assorted Pins
Tape Measure	Adhesive Strapping
Holders containing Nitrate of Silver and Sulphate of Copper	Spatula.

The instruments are best kept in rectified spirit during the time between their sterilization and their immersion in the tray of 1-40 carbolic, and should include :—

Scissors	Sinus Forceps
Dressing Forceps	Long and Short Probes
Dissecting Forceps	Needles.

The first preliminary in every case is to get the patient into a position which is both comfortable and accessible, and where the light will be good. Then the fixing outside dressings are removed by an assistant or the sister, and mackintoshes and towels arranged around. Sponge cloths are useful for packing at the side, to collect any lotion that may trickle down. The dressing next the wound is then taken off, placed in a "receiver," and conveyed out of the ward by a nurse. These receivers are conveniently made circular and flat-bottomed, with shallow sides and a handle. Block tin is perhaps the best material, and one of the cheapest.

The wound is now exposed, and is dealt with according to circumstances. It used to be the general practice to at once cover it with some protective, such as a swab soaked in carbolic acid lotion, because aërial infection was what was most feared. Recent work has shown that under ordinary circumstances this channel of infection is of secondary importance, but it will depend upon surroundings, and in these days of large and full wards we cannot disregard it. It is best guarded against by rapidity in working, and by gentle irrigation with the dilute antiseptic in use; there is no necessity for pressing down on the wound a swab containing a strong antiseptic. Sponges or swabs used to cleanse the surrounding skin are of course not allowed to come in contact with the wound itself.

The new dressing will be ready, cut to shape. It may be either aseptic, when it is to be used dry, or antiseptic, when it should be applied wet. This question of dressings is, however, discussed in the next essay.

It adds greatly to the interest and value of ward work, if inoculations are made from time to time on agar or gelatine tubes; it is unnecessary to point out all the valuable lessons on the

reliability of our procedure that can be learnt if this be systematically done, and also the light it throws on the study of the healing of wounds and its retardation.

Before passing to a second case, hands must be again washed and soaked in lotion, a second treatment with ether or turpentine being unnecessary. The instruments used are cleansed of any blood or serum with which they may have come in contact, and replaced in the tray containing 1-40 carbolic; any further sterilization at this stage, where a series of presumably aseptic wounds are being dressed, seems altogether superfluous.

After these clean wounds have all been dealt with, we turn to those that are otherwise. In dressing them it is quite necessary to use separate mackintoshes, etc.; in fact, everything that is to come near them, unless it can be absolutely sterilized by heat afterwards. All metal instruments, whatever may have happened to them, can always be reliably re-cleaned; but sponges, mackintoshes, and such like are more difficult to deal with satisfactorily, and, once contaminated by anything like a virulent infection, must always be looked on with suspicion.



It is also often wise to use duplicate sets of instruments in dressing these cases ; and as all that are usually required are scissors, forceps, with perhaps a probe, and the nozzle of an irrigator, this is easily managed. After the ward visit they are sterilized in the boiling soda solution, and are therefore perfectly safe to use for any case next day.

The septic cases for the most part take longer to dress than the others ; not only is the treatment of the wound itself generally more complicated, but the cleansing of hands in between them must be done more energetically ; because one patient has a certain growth of organisms in his wound, that is no reason why he should be inoculated with another and perhaps more virulent affection from the case next him.

With regard to patients without wounds, the attention necessary is outside the purpose of this essay.

System and regularity are required if all the work is to be got through rapidly and smoothly. Once these are established, their value is appreciated by everyone concerned, from the patient upwards. Instead of all these formalities taking up a large amount of time, in

practice the man who does his work on some such system will be round his wards long before the one who potters from bed to bed in the happy-go-lucky manner that is by no means uncommon.

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*VII.***THE DRESSINGS.**

THE suitability of a dressing depends, of course, on the nature of the wound to be dressed. First, we will consider the dressings suitable to wounds made by the surgeon through unbroken skin.

When the operation has been conducted under the most favourable circumstances, when surgeon, assistants, nurses, and instruments are alike immaculate, then the aseptic dressing is the ideal one. At the present day this can only be used as routine practice in a few, but increasing number of hospitals. Some form of steam sterilizer is necessary for its preparation, such as Koch's or Lautenschläger's. The day before operation is the proper time to prepare such dressings; they must all be carefully cut to shape. Each consists essentially of two parts—the inner, immediately covering the wound, and the outer, whose purpose is to give still further protection and support.

The first is best formed of absorbent gauze, cut

in pieces eight folds thick, and always of sufficient size to leave a margin of some three inches round the wound. Some three or four layers of these pieces will probably be necessary. Next the gauze comes absorbent wool, and together these form the inner dressing. The outer must be of material with more rigidity, such as wood wool or gamgee "tissue," or moss board. In most cases it is advisable to take a pattern first, and to cut the material accordingly. As examples of cases where this supporting dressing is of great importance we may instance, excision of cervical glands and other operations about the neck; amputation of the breast; and operations about the groin. In the latter cases, especially in children, it is advisable to make the dressing waterproof.

The value of these supporting dressings in ensuring rest to the part during the healing process cannot be too much insisted on, especially if wounds are of large extent, or if there has been much difficulty in bringing surfaces and edges together; and they are specially required in certain regions of the body where movement is, under ordinary circumstances free, the neck, the axilla, and the groin, so much so that they

must be considered quite indispensable here. In the case of the neck, the dressing, cut from wood-wool tissue or gamgee tissue, is made up of a rectangular upright portion for the side, reaching up to the temporal fossa, and two horizontal limbs, the upper and narrower to encircle the forehead, the lower, three times the width, to



encircle the chin and hyoid region. To make this fit the shoulder a gusset must be let into the lower border. The shape of the whole is seen in the accompanying diagram.

When this has been firmly bandaged in position by a triple spica, all movements are controlled.

For cases of amputation of the breast, a cuirass-like dressing is cut, covering the front of the chest, passing round the side affected to the middle of the back behind. It passes up over the shoulder before and behind, and is secured there by tapes; a short sleeve reaches half-way down the upper arm. The arm is first inserted into this sleeve, and the rest of the dressing falls naturally into its place and is secured.

The groin dressing is best made triangular: to the angles of the base of the triangle pieces

of bandage are sewn, and encircle the pelvis, to be secured in front; a similar piece is attached to the apex, and passing round behind the thigh and then forwards, is also fixed in front. Here it is best that the dressing should be made waterproof by covering it with mackintosh.

Both outer and inner dressings having been thus cut and prepared, are to be sterilized. They are placed in one of the circular metal boxes belonging to the sterilizer, and on the morning of the day when they are required the process is gone through. When complete, the box is made air-tight by closing its side apertures, and lifted out of the sterilizer. This is not opened until the dressing is wanted.

The box will contain dressings for several patients, and they should be put in in reverse order to that in which they will be used, and separated by enclosing them in a fold of paper on which the patient's name is written. When such a dressing is used it is of course unnecessary to select gauze and wool that has been impregnated with an antiseptic.

A single dressing of gauze can be sterilized by boiling in an instrument sterilizer or an ordinary saucepan, when there is no proper

apparatus for its preparation, and the plan may be useful in private work. Of course the gauze only can be so treated, so that it is necessary to have an antiseptic wool dressing outside it.

It is impossible to lay down any general law as to the choice between aseptic and antiseptic dressings. There can be no question that the aseptic principle is theoretically in advance of the antiseptic, when studied in relation to the behaviour and reactions of healthy wounds; and in the second place, no one who has had experience of the kindliness with which an aseptic wound heals under an aseptic dressing doubts that in practice also the method is ideal. It is no less true that wounds can be got to heal perfectly and satisfactorily under antiseptic treatment, though those who have compared the two in their own practice will, we think, agree that the healing is neither so rapid nor altogether so uneventful. If we undertake the aseptic treatment entirely, we, as it were, burn our boats behind us, and must feel convinced of our ability to exclude all organisms. If we are so happily placed as to have this confidence, well and good.

For ordinary ward work, and for most private work, however, a modified antiseptic method

seems still the most suitable; modified by in reality approaching nearer and nearer to the aseptic in the use of more dilute and less irritating antiseptics. No one now-a-days deluges his wound with a spray of 1-20 carbolic acid, no one dusts into a clean cut a mass of antiseptic powder; the milder, less irritating chemicals are chosen, as mild in fact as is compatible with their efficiency to do their work; and their work is that of protection. They attack the enemy in the field, and so keep their citadel inviolate; they do not wait until he is within their walls, where, in exterminating him they would bring partial destruction on those very walls themselves.

We may take it then that the surgeon cannot exclude the antiseptic dressing from his armamentarium, and as a matter of fact the vast majority of wounds are still, in England at least, dressed with it.

There are a large number of chemicals and dressings impregnated with chemicals in use, gauzes, lints, wools, powders, lotions, etc.; and, to repeat, in making choice of these, we must select those that are efficient, and at the same time cause the least possible amount of irritation



in contact with the tissues; and secondly, in using them we remember that they are to be applied to the surroundings of the wound rather than to the actual wound itself. For example, iodoform is an excellent and useful powder, but the habit of dusting it freely into a clean cut wound is altogether to be condemned.

The part of the dressing nearest the wound is prepared gauze, and of all those in use that impregnated with the double cyanide of mercury and zinc is to be preferred; it best fulfils the conditions of efficiency and freedom from irritating qualities. Of the others, sal alembroth is much more irritating, and not infrequently causes blistering; it also leaves an unsightly and, at the least, undesirable stain upon the skin, and it cannot be used with biniodide of mercury lotion, as the yellow oxide is precipitated. Carbolic gauze is perhaps next in value to the double cyanide, but rather more irritating, and the latter remark applies to salicylic gauze—the most expensive of the four.

These gauzes are sterilized first in the process of manufacture, and then impregnated with the chemical and dried. In folding and packing we do not know what hands have come in contact

with them, and when they reach us we cannot possibly be certain that they have not been contaminated. They are dry, and in the dry state the antiseptic is inert, so that we cannot apply them in this state to our wound; they must be soaked in lotion. For use with either the double cyanide or the carbolic gauze, a 1-4000 solution of biniodide of mercury is the most suitable. A short immersion in this renders it sterile. It is left in the lotion until required, and then taken out by the surgeon himself, so that it may pass through as few hands as possible.

Next to the gauze layer comes the impregnated absorbent wool, and we have the choice of several efficient kinds—carbolic, sublimate, salicylic acid, sal alembroth. For ordinary use the sublimate is perhaps most convenient, though the choice is not a matter of any very great importance.

As described above, the whole is completed by an outside fixing covering, shaped as required, of some more rigid material, wood-wool tissue for instance, which is also made waterproof if necessary. Before applying this antiseptic dressing, many use a dusting powder round the wound. This is valuable for preventing decom-

position in the natural secretions of the skin here, and it also lessens the irritation of a dressing which is, under ordinary circumstances, left in position for several days.

So far we have considered dressings for clean operation wounds.

Accidental wounds, of the casualty room, must be dressed on the assumption that they have been contaminated. That is to say, the wound itself is to be disinfected before any dressing is applied.

The surrounding parts are first to be cleaned with a nail brush and soap and water, after the use of the razor, if necessary, and turpentine completes the process; then the wound must be examined for any foreign matter, and this removed with forceps and a swab. After that carbolic acid lotion, 1-40, is applied to both wound and skin around, and iodoform powder dusted over the whole.

The dressing to be applied is the antiseptic dressing which has just been described above.

In the casualty room, gauzes, lints, and wools, are best kept in air-tight tins made of polished block tin. Each packet of gauze is cut into strips eight folds thick, and the wool also

divided up, and cut into pieces the size of the box. When used for these accidental wounds, the lotion in which the gauze is soaked before application, should be of greater strength than that ordinarily used; for instance, biniodide of mercury 1-2,000. This is necessary, both because of the possible infection of the wound, and because, owing to the short immersion of the gauze that is possible, its sterility cannot be so satisfactorily insured.

Where we have an actively septic wound, or a septic sinus to deal with, thorough and complete disinfection is very difficult to effect. The first thing is to remove all dead and necrosing matter; therefore the edges of the wound, if gangrenous, and any slough upon the floor must be cut away with scissors; and in the case of the sinus a sharp spoon should be energetically used. Next, the wound is thoroughly irrigated with an antiseptic lotion, such as 1-2,000 biniodide, or 1-30 carbolic, to remove all remaining *débris*, and lastly, the whole is loosely packed with iodoform gauze.

It is important that the discharges should not be allowed to dry, or the gauze will act as a plug, simply keeping them in the depths of

the wound. Therefore the covering dressing must be of the nature of a fomentation, that is to say, gauze wrung out of lotion and covered with mackintosh or gutta-percha tissue.

Certain large septic wounds, such as a septic synovitis of the knee, are especially difficult to deal with, and, however carefully they may be packed with gauze, there is a tendency to the retention of discharge. It is in these cases that continuous irrigation is useful: lotion may be slowly siphoned into and through the wound, and by an arrangement of mackintoshes in the form of a gutter, caught in a suitable receptacle at the side of the bed; or the apparatus used may be in the form of a reservoir, emptying itself through the tissues of the wound into a bath beneath it, which is emptied from time to time.

Apart from the difficulty of drainage, septic wounds of the arm and leg, the hand and foot, are much benefited by the use of the antiseptic bath; especially where we have to deal with a virulent cellulitis, a thecal abscess that has spread up the arm, and such serious and difficult cases.

Boracic acid or boro-glyceride are the best lotions for use in the bath, and must be kept at

a temperature of 100° F., by adding boiling water to them from time to time, and changing the whole every two hours. During the night large hot fomentations may take the place of this, being changed every three or four hours.

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## VIII.

## ANTISEPTIC CHEMICALS.

A HOST of chemical agents have been recommended from time to time, all with the object of preventing the contamination of wounds, or cleansing those already infected. A large number of these have had a few papers written in praise of their excellence, and have then been straightway forgotten. The following notes are simply a *résumé* of facts concerning those most generally employed, and whose usefulness seems to have been well proved.

**Carbolic Acid.**—This is used occasionally in the form of pure liquefied carbolic, in glycerine, 1 in 2, as a germicide ; for example, in the disinfection of a septic sinus, and in the destruction of a lupus focus. It is also used of this strength by some surgeons to purify an instrument, when time does not admit of other methods.

As a 5 per cent. solution (1-20) it is the best antiseptic in which to store sponges, swabs, drainage tubing, ligatures and sutures ; and also

for the preparation of antiseptic towels to be spread around the operation area. Of the strength 1 in 40, it is useful for covering instruments already sterilized, in the instrument tray; if used more concentrated its tendency to cause rust is greater, and also to spoil the edges of knives and scissors.

In the casualty room, for accidental wounds it is of great value. No lotion gives more satisfactory results in the treatment of the wounds of ordinary out-patients. Its irritating qualities, however, render it unsuitable for application to surgical wounds, and its anæsthetic action completely excludes its use as a lotion for the hands during an operation of any length.

**Perchloride of Mercury.**—The strongest solution used of this drug is, 1 in 500. In this form it is contained in what is usually spoken of as Lister's Strong Mixture, *i.e.*, a solution of this strength in 5 per cent. carbolic acid. In this form it may be used in the sterilization of skin after the extraction of the fatty matters, but cannot be left in contact as a dressing for more than three hours, and in any case is unnecessarily irritating and injurious to vitality.

Of the strength 1 in 2,000, it is useful as a



lotion for the hands during the course of an operation; but more important than this is its application as a wet dressing in contact with the operation area, and if not used stronger than 1 in 2,000, the dressing may be left in position overnight, that is to say, for some eight or nine hours.

This chemical has, however, very many disadvantages: it is irritating and very toxic if absorbed; in contact with the tissues it is readily decomposed into an albuminate, and becomes inert; with blood it forms a compound which stains the nails in a most inconvenient way; and its action in tarnishing instruments is well known.

Its decomposition in contact with albumen is largely avoided by combining it with ammonium chloride, to form the double salt commonly called sal alembroth, but, on the other hand, this is probably the most irritating chemical in the whole list of antiseptics in use, as the frequency with which it vesicates the skin witnesses. In simple watery solutions a white precipitate usually forms after a time, but is easily prevented by the addition of sodium chloride in small quantity.

**Biniodide of Mercury.**—This has all the advantages, and lacks many of the disadvantages of the bichloride. It forms no compound with blood and the tissue albumins, and it does not tarnish metal; it is less irritating than the perchloride, and more efficient as a disinfectant.

As a solution of  $\text{I}$  in 500 water or spirit it is used for the disinfection of the skin of the patient and the hands of the operator. It cannot, however, be left in contact with the patient's skin in so concentrated a solution as this, and if it is applied as a wet dressing overnight it should not be stronger than  $\text{I}$  in 3,000, or there will be danger of blistering. During the operation it may be used ( $\text{I}$ –2,000) to cleanse and rinse sponges, for bathing the hands from time to time, and to cover instruments. Its non-irritating quality also allows of its being used occasionally to irrigate a wound; but it must be still weaker, about  $\text{I}$  in 4,000.

It may be kept as stock solution,  $\text{I}$  in 50 in rectified spirit, or prepared as a  $\text{I}$  in 500 solution in water, according to the following formula :

℞ Hydr. Perchl. grs. xxiv		Aq. Calid.	℥lxxx
Pot Iodid.	℥ij		

Dissolve each salt separately in  $\text{Oj}$  warm

water, mix the two solutions, and add water to Oiv.

**Boro-glyceride.**—This is used usually of the strength of half an ounce to the pint of sterilized water. In this form it is a bland and unirritating fluid, with mild though considerable antiseptic qualities. It is therefore very suitable for irrigation of the peritoneal cavity, also where the tissues remain long in contact with the antiseptic, as in the foot and arm baths, and in many similar ways. It is very suitable in cleansing mucous membranes, as a wash or spray; for example, in the after-treatment of a tracheotomy. Superficial contused wounds, as from a fall on gravel, heal readily under boro-glyceride used as a wet dressing.

**Picric Acid.**—Probably this is the best dressing for burns that we possess. It is prepared for use according to the formula:—

℞ Picric Acid	grs. xlv	Aq. Destill. ad
Abs. Alcohol	℥iiss	

Gauze wrung out of this may be left in position for three days. It is anæsthetic as well as antiseptic, so that much of the pain and distress which attend the dressing of burns is avoided by its use.

**Sulphurous Acid Lotion.**—As a lotion of the

strength of 1 in 5, this is of great use in the dressing of superficial wounds already septic and foul; for instance, chronic ulcers of the leg and elsewhere. It should be used as a wet dressing, and discontinued when the granulations are healthy.

**Boracic Acid.**—This is used both in solution and as a dusting powder. It possesses only mild disinfecting powers, but being non-irritating and non-poisonous, it is very useful for application to delicate and highly absorptive tissues.

As a lotion it is used in the cleansing of mucous and serous membranes, the mouth and nose, the stomach, the rectum (though it is hardly a good enough disinfectant for this), and the pleural and peritoneal cavities; also in the continuous bath, and for continuous irrigation; and, very largely, in ophthalmic surgery. The usual strength of the lotion is from 2 to 4 per cent. As an antiseptic powder it is used for insufflation in nasal and aural surgery. It causes a good deal of pain if dusted on to burns and superficial excoriations, and therefore is unsuitable for this purpose.

As a dusting powder, it is most useful in combination: added in equal part to iodoform it makes the latter much less liable to cake; also,

with an equal part of starch powder, it forms probably the most useful dusting powder for routine use in the wards.

**Iodoform.**—In spite of its many rivals, iodoform still stands first on the list of antiseptic powders.

The habit of dusting it into a clean surgical wound is to be condemned, but round a wound it aids in preventing the access of organisms, and the decomposition of any discharge. It also moderates the irritating effect which some antiseptics have upon the skin, and should therefore be used when dressings containing them are left long in position.

A so-called emulsion is made by suspending 1 part in 10 parts of glycerine and 1 of mucilage, and this is used for injection into sinuses and abscess cavities.

The mixture of iodoform and collodion—useful so often where other dressings are inconvenient, as on the face, or difficult to retain, as in the groin of children—should be freshly prepared each time it is used.

This powder has been used from time to time in a host of combinations, the enumeration of which would serve no useful purpose. For the

disinfection of the rectum and vagina, before and after operation, it is indispensable. In fact, in the case of most wounds, the asepsis of which is uncertain from the first, or difficult to maintain, most surgeons fall back upon iodoform.

**Loretin.**—One of the most useful of the newer dusting powders, it gives rise to no pain or irritation when insufflated on to the surface of a wound, and has marked deodorising properties. It does not form the sticky paste in the presence of moisture that several of its rivals do. Its uses are similar to those of iodoform, over which it has the advantages of being odourless and non-toxic. If used as a simple dusting powder on the unbroken skin, it is best mixed with starch powder or French chalk.

**Acetanilidum.**—A crystalline powder with many advantages, it is useful for all septic wounds except, perhaps, those that are very extensive and where toxic effects are to be feared; and it is specially valuable as a covering for venereal sores. It is employed as a powder simply, or as an emulsion in glycerine, or as an impregnated gauze. Its advantages are these: it does not cake in the way iodoform does, it has a distinct sedative effect, and a marked drying effect on

discharge. It is also odourless, and, a not unimportant matter, it is cheap.

All these dusting powders are kept in a receptacle made on the pattern of the time-honoured pepper-caster, but some expedient should be used to prevent dust getting access to the inside, such as making the holes closeable by a twist of the top of the caster.

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## IX.

**DRAINAGE.**

IN the treatment of a wound, the provision for satisfactory drainage, when the character of the wound demands it, is second only in importance to the exclusion of all that may contaminate it.

Everything in contact with the surfaces of a healing wound, except the small amount of blood-clot and serum which glues those surfaces together, and through the medium of which healing proceeds, must be considered in the light of a foreign body, and therefore prejudicial to that healing process.

Our means of arresting hæmorrhage, however, are now so nearly perfect, that we can in most cases anticipate the necessity for drainage, and close our wounds completely without fear of any untoward consequences. An open wound is always a source of some danger, and the correct and complete apposition of the edges is not the least important of prophylactic measures against contamination.



Drainage, therefore, is only tolerated as an occasional necessary evil ; and to avoid having to employ it in surgical wounds by careful arrest of all hæmorrhage is always to be desired.

Our four most useful means of checking hæmorrhage are the ligature, twisting and compression by forceps, and sponge pressure, and the surgeon will use one of these according to the size of the vessels with which he has to deal.

Consequently, it is always of importance that he should trace all bleeding to its exact source. The temptation to trust to the pressure of the dressing or to "plugging" must be overcome, and time is usually lost in the end when it is indulged.

In dealing with vessels in certain localities however, the surgeon is under the necessity of using the plug. For instance, when he has to stop hæmorrhage from diploic veins, he employs sterilized wax in this way ; and when an incision has to be made through the very vascular tissue of the liver, the gauze plug is his most efficient instrument. These are exceptions, however, and do not alter the rule that true prophylaxis against the evil of drainage lies in the exact and immediate occlusion of all bleeding points.

To prevent any collection of discharge in the deeper parts of a large wound, it is necessary that no pockets be left; that is to say, means must be taken to bring the two surfaces in contact over their whole extent.

For this purpose buried sutures will occasionally be called for; but the proper application of the dressing is the point of most importance. By this means pressure can be employed lightly and uniformly over the whole area, and friction between the surfaces prevented. The rubbing of two such surfaces over one another would naturally increase the amount of serous oozing, and tend to re-open vessels which are in course of occlusion.

When it was the habit to apply strong anti-septic powders and lotions directly to the wounds, drainage was much more often called for; but in these days, when every surgeon has drawn nearer to the practice of the aseptic method, and applies his methods of disinfection to what comes in contact with the wound rather than to the wound itself, drainage is only necessary where the wound is very large, and where it is difficult to be certain that no pockets are left in the recesses. For instance, the majority of careful surgeons still employ it where they have to deal

with a large amputation stump, after amputation of the breast, and after the removal of vascular tumours of the neck.

The drainage aperture must be dependent, and it is therefore occasionally necessary to make it apart from the original incision. Thus, after amputation of the breast it is best to button-hole the lower flap and close up the whole extent of the operation wound, and some surgeons have adopted the same plan in dealing with stumps after amputation by antero-posterior flaps.

For these surgically clean wounds, no material is so satisfactory as rubber tubing; there is no reason whatever for preferring gauze. The tube is to be of good size, is cut off exactly flush with the surface, and retained in position by a stitch. Twenty-four hours after operation, if all is well, it may be entirely removed, and the aperture closed by a single horse-hair suture.

No more extensive rules are necessary for the use of drainage in ordinary operation wounds. In abdominal surgery, however, the matter requires separate consideration, and is not nearly so simple. It is impossible in most cases to provide a dependent drain, though the formation of a counter-opening in the posterior wall has

been advantageously carried out in some cases. It is, however, only rarely of use. We have, as a rule, to provide for the passage of fluid in an upward direction. Its tendency is to gravitate to the pelvis and other dependent parts, so that communication is to be kept up between these and the skin wound directly. The natural intra-abdominal pressure and the fact that under normal conditions there is no peritoneal *cavity*, ensures the removal of discharge, provided only a free exit is available. To recognise this is of great importance. Here we have to deal with no collapsing elastic lung, but with elastic parietes which resist any increase in the bulk of their contents. Efficient suturing of the wound is to be first attended to, then the drainage material is to be introduced, fitting accurately the aperture left, down to the dependent parts. For general use the best method of drainage is by glass tubes (Keith's); they are made of different diameters, open at both ends, and with perforations towards the lower.

Through these tubes blood and serum pass readily, and they can easily be kept patent; but, in addition, active extraction of fluid by aspiration can be made through them. For this

purpose a small exhausting syringe fitting the mouth is used, and the method is certainly called for whenever there is bleeding after operation. The writer's experience of the so-called capillary drainage by gauze introduced into the abdominal cavity has not been a happy one. The gauze drain has a great tendency to transform itself into a plug, barring instead of facilitating the escape of discharge. Evaporation often causes the gauze in this way to form a firm cake at the level of the wound, and capillary attraction, where the material, from this downwards, is in contact with absorptive surfaces, ceases to be of any real efficiency. However, this process of capillary attraction can be taken advantage of by placing narrow wicks of gauze loosely inside the tubes, and the upward passage of fluid is certainly thus facilitated.

Where we have to deal with an intra-abdominal septic focus, the case is very different. Here our object is to shut this off from the general peritoneal surface as well as to drain it efficiently. Round a strip of gauze introduced down to the focus, plastic effusion takes place, and a channel is formed to the surface beyond whose walls the septic matter will not spread. The mouth of

the wound is left as open as is possible, and the gauze changed frequently. The gauze stimulates the formation of granulations, and the sinus heals from the bottom.

Acute and sub-acute abscesses in all situations require drainage for a more or less extended period. After incision, it is first necessary to make sure that there are no loculi left that are not in free communication with the wound, and any septa shutting these off are broken down by the finger. The depth of the cavity having been estimated, a drainage tube reaching almost to the bottom is inserted, and prevented from slipping by a safety pin. The dressing will require renewal frequently at first, and as the cavity closes the tube is gradually shortened. It is best to keep this of the same calibre throughout, so that all risk of accumulation of discharge is avoided to the end. Drainage by gauze may also with care be made efficient. A long single strip is used, and lightly packed into the cavity, the end being brought out at the wound. Too rapid drying of the superficial layers must be prevented by covering the dressing with gutta percha tissue, or it may tend to form a firm plug, as above alluded to, at the mouth of the wound, and all escape of discharge be prevented.

The gauze must be brought everywhere in contact with the walls of the cavity. This dressing will require renewal twice at least in the first twenty-four hours, and after that with diminishing frequency, as the granulations grow and obliterate the cavity.

It is generally agreed that an attempt should always be made to induce chronic tubercular abscesses to heal without drainage. Success depends largely on the absence of all pyogenic infection. After the use of the sharp spoon (or the scissors, where the whole wall of the abscess can be removed) and the irrigator, the whole cavity must be very carefully dried and the skin incision sewn up. Iodoform emulsion may or may not be injected. To keep the wound open only adds to the imminent danger of its infection, and the worst that can happen is a re-accumulation of fluid, which is evacuated after the same method as the first collection.

Where the disaster of pyogenic infection has taken place, attempts to asepticise the sinus are sometimes successful by free use of the spoon and a strong antiseptic lotion, such as 1-1000 biniodide of mercury; this is followed by saturation with iodoform emulsion. After such an operation drainage is necessary, and in these of all cases it must be perfect. Iodoform gauze packing is the best method.

## X.

**INSTRUMENTS.**

THE surgeon, in common with other artists, requires tools for the performance of his art, and it is essential to his real success that he should acquire facility in the use of them.

His hand must be so trained that it always retains complete control over the instrument it holds; no instrument, however complicated and ingenious, can be trusted to do its work in despite of clumsy manipulation. One often sees an instrument used as if it possessed, of itself, some special virtue which enables it always to perform its work correctly and without danger. For instance, to take a common example, one sees dissecting forceps used to catch hold of any tissue from the skin downwards, so long as a hold is taken somehow and of something—with the result that when the time comes to apply sutures, the skin edges are lacerated and bruised, and their vitality proportionately lowered. And then surprise is expressed that union by first intention fails. Pressure forceps, again, are



amongst the most valuable and prized of all instruments, but when a surgeon uses them to enclose not only vessels but considerable masses of tissue around, it is a pity, as far as he is concerned, that they were ever invented. Some may doubt if surgeons ever transgress in this way. Of course, a student rarely, if ever, sees such practices during his hospital days, but he is liable to forget that the facility and care in manipulation which he sees there are born of long practice and experience, that his own fingers have to learn these, and that when he has selected his instruments and decided on his procedure, the success of his operation is no more ensured than the success of a picture when brushes and subject have been chosen by the painter. At the present time, when operative work is undertaken by so many men of limited experience, this lesson is a very necessary one, or the use of the knife will suffer much in public estimation.

When the student witnesses at his hospital a long series of successes and uncomplicated recoveries, the difficulties that have been overcome before this perfection has been attained do not impress him. He sees no reason why,

given the opportunity and the instruments, he should not have like success, and he anticipates it with more or less enthusiasm. When the opportunity arrives he is disheartened and disgusted by his experience. He finds that he has not that complete control over hæmorrhage that seemed so easy by the mere handling of pressure forceps; his skin incisions do not seem to be so easy of coaptation; organs and tissues escape through his fingers as if they actually resented inspection; and even the vulsellum forceps will not always retain their somewhat barbarous grip. Perhaps he may have to close his wound without attaining his object. If he is wise he will recognise that the fault lies in his untrained fingers; if he is not, he will probably turn round and blame his instruments, and perhaps invent some wonder of springs and screws, and send a description of it to the medical papers. But he is only publishing abroad the incompetency of his own hands. Probably all surgeons, even those of greatest eminence, have had to go through some such disheartening experience as is pictured here.

Once impressed with the difficulties in gaining complete mastery over his instruments, the

surgeon will see the advisability of limiting the number he uses, and will only introduce a new one into his list for some very good reason. The scalpel and dissecting forceps are the first it falls to the student to handle, making acquaintance with them in the dissecting room; and if his dissections are carefully and delicately carried out he will learn much about their proper use. He also has an opportunity of handling the saw, and even though it may be but once or twice, he may at least learn that long and rapid strokes without the use of much force, are preferable and more effective than the kind of nibbling with the point one sometimes sees. Little real use is made in the dissecting room of the opportunities of educating the fingers to the use of these instruments, though these opportunities are unique.

Practice in the *post-mortem* room will not add much to his capabilities, and he must in a sense beware of carrying the methods of using the knife, proper there, to the operating theatre. Boldness in the use of the knife in the latter is not to be learnt here. Opportunities will occur, however, especially in *post-mortems* on surgical cases, of making dissections of

great value. For instance, where the patient has been the subject of an abdominal tumour, the time spent in removing this by surgical methods is time spent well ; and the instances could be multiplied in which the same practice can be usefully followed.

But the *post-mortem* clerk learns more of surgical pathology than of surgical technique, and it is right that he should do so. Later he leaves studenthood behind him and becomes, if he is fortunate, a house surgeon. This of course is his great opportunity. His best lessons are to be learnt while assisting a master surgeon at operations. His own fingers may learn facility in the use of several instruments, pressure forceps, and ligatures, hooks, retractors, and scissors, but most of all, if his receptive faculty is at all developed, he will learn much simply through association in the work of a master hand ; his observation absorbs the various details and steps, and though his fingers may not have much actual practice yet he is all the while accumulating potential capacity which will, with added work and opportunity, become actual. It is well that he should from the first appreciate the fact that he is witnessing a

manipulative facility to attain which real difficulties have been overcome. Even though his hands be employed only in retracting tissues, manipulating forceps for the application of ligatures, and such modest work, they become more surgical, less clumsy, not so much in the way, and acquire a certain delicacy of touch through the mere respectful handling of living tissues which they will not attain to in any other way. He will probably, at least, have some practice in stitching, and will do well to make the most of it, because the lesson of rapid and accurate stitching is one of no small importance to learn, and more time is lost doing it clumsily than in almost any other manipulation on the table.

The selection of instruments before operation is an important, though a simple, matter. The rule may be at once laid down that it is better to put out not only those that will, but also those that may, be required.

Whoever has charge of the duty will find it best to go over in his mind the various steps of the coming operation, and he may also, of course, have to consider the preferences of the surgeon who is about to perform it. The duty

should not be left to a nurse as a rule, or most probably recourse will have to be had to the instrument case during the operation, and no blame can be thrown upon her if it so happen. Once selected they are to be prepared for use by sterilization. It is the custom in some hospitals, metropolitan among the number, to do this by immersion in a solution of 1-20 carbolic for half-an-hour before use. The sterilization is probably effectual, though this is a debated question; but in the writer's experience the plan invariably causes rusting. A solution of the strength 1-40, does not cause this nearly so soon, but it is of course less effectual.

Sterilization by immersion in boiling soda-solution, the commoner practice now-a-days, is always effectual and also convenient. Of course it is only practicable in the case of instruments made wholly of metal, but as wooden and ivory handles are altogether out of date now, this restriction does not remain as an objection. The soda solution is of the strength,  $\frac{1}{2}$  oz. to the pint; by its use rust is altogether avoided, and the sharpness of knives, scissors, etc., is unimpaired. The apparatus required is of the very simplest. No complications can improve upon

the sterilizer made after the pattern of the common fish-kettle, only of oblong instead of ovoid shape. The false bottom with side handles enables the instruments to be lifted out together and transferred to the instrument tray when sterilization is complete.

If the operation is being conducted on the strictest aseptic principles, this tray will either contain sterilized water, or nothing but a layer of dry sterilized wool. However, for ordinary purposes a solution of 1-40 carbolic is very suitable, and unless a surgeon feels certain of the impossibility of aërial infection he must cover them with some fluid.

Ten minutes is the utmost limit to which this immersion in boiling soda-solution need be extended; in fact, ordinary pyogenic microbes are killed in ten seconds, and the most resistant of spores apparently cannot stand a two minutes' immersion. Therefore it is also the most convenient method of disinfecting an instrument required unexpectedly during an operation, more penetrating even than undiluted carbolic acid, and as rapid in its action.

After use, instruments must be carefully cleaned. This is of course, in hospital, the duty

of the theatre nurse, but she will be none the worse for instruction in a good method. First of all, blood-clot must be thoroughly removed with the nail brush in *warm* water; they are then dried and polished with metal paste; thirdly, they are placed in boiling soda-solution for ten minutes, and afterwards carefully dried and put back on the glass shelves of the instrument case.

These rules for the disinfection and care of instruments can be carried out in principle under all circumstances, in hospitals or in private work.

The care of ligatures, sutures, and sponges may properly be discussed under the head of instruments, and hence we shall deal with them here.

The most widely used materials for ligatures are catgut and silk.

Catgut will not stand boiling; the simplest way of preparing it for use is by first immersing it in ether for forty-eight hours, and then transferring it to a tank containing 1-20 carbolic acid. This lotion will require renewal weekly.

Silk is best prepared by boiling in soda solution for ten minutes, and after this it may be placed in the carbolic acid tank.



Silkworm-gut and horsehair are the best suture materials, and are boiled before storage in 1-20 carbolic acid. A small amount only of horsehair should be stored at a time, the carbolic soon making it rotten.

Metal boxes containing reels are now used largely for boiling these ligature and suture materials, and are very convenient.

Sponges are best cleaned after operation in the following way: First, squeeze them free of blood, etc., in warm water; then wash in warm soda solution, and again in warm sterilized water to remove the soda; then immerse them for twelve hours in 1-20 carbolic acid; after this they are wrung dry with surgically clean hands, and stored in sterile and air-tight glass jars. When required, they are taken half-an-hour before operation, and immersed in 1-2,000 biniodide ready for use. During the operation they are rinsed first in a basin containing warm soda solution, and then in warm sterilized water, and after that returned to the bowl of biniodide. If they become discoloured they are placed in 20 per cent. sulphurous acid for twelve hours, before storing them in the carbolic acid.

Swabs are the alternative to sponges, and the

necessity for their proper preparation has been already touched upon. They are not so convenient to handle as good sponges, but have the advantage that they are used once only, and once prepared cannot act as a channel of infection. The pledget of wool surrounded by a small bag of gauze is the best form, and the trouble of making them is insignificant, each not taking more than thirty seconds. As already mentioned, they are to be boiled for a quarter of an hour, and after that stored in 1-20 carbolic.

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## APPENDIX.

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### SURGICAL RULES FOR NURSES.

#### THEATRE.

1. The theatre floor and walls to be washed after use.
2. The floor to be swept, and the furniture dusted, every morning early.
3. The furniture to be scrubbed weekly by the nurse in charge, and at other times as required.
4. The instrument case to be inspected weekly, to see that the instruments are in their places, and to dust the shelves.

#### OPERATIONS.

1. There shall be four nurses present at ordinary operations; one to the right, and two to the left of the table; the fourth near the left hand of the anæsthetist.
2. They shall take the following precautions:  
(a) Their aprons shall be clean; (b) Their cuffs removed and their sleeves turned up to the

elbow ; (c) Their hands to be cleaned as follows : wash energetically with soap and water for five minutes, paying special attention to the nails ; then saturate the epidermis with turpentine and wash and rub for another two minutes with a solution of biniodide of mercury (1-1000).

3. *Each nurse shall attend absolutely to her own duties alone.*

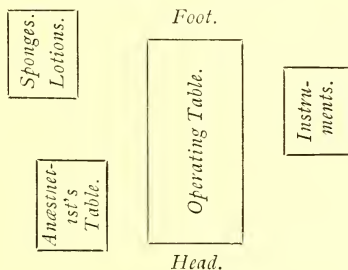
4. Nurse I shall have charge of the instruments, sutures and ligatures, and shall touch nothing else after disinfecting her hands. Nurse II shall stand to the left of the foot of the operating table, and be responsible for the lotions, sponges or swabs which may be required. Nurse III shall receive the soiled sponges from the surgeon in a surgically clean lotion bowl, and rinse them thoroughly in warm boiled water and soda. If swabs are used she shall be responsible for their supply, and she shall also renew from time to time the lotions which are required.

The duties of Nurse IV will vary with the occasion. She alone shall touch the blanket when the site of operation is uncovered ; it shall be her duty to surround the area of operation with mackintoshes and towels spread evenly

over them; she alone shall remove the bandages, if required to do so by surgeon. She shall remove any instrument, sponge, towel, etc., which may happen to fall on the floor. She alone shall go to the instrument cupboard, or carry any message from the theatre if required to do so by the surgeon.

5. If there be only three Nurses present at the operation, any of the above duties that may be required shall fall to Nurse III, and she shall on each occasion re-disinfect her hands afterwards.

6. The operating theatre shall, under ordinary circumstances, be arranged thus:—



7. The following is the technique of an ordinary operation. The patient is brought by porters into the theatre or anæsthetising room. Nurse IV removes slippers, dressing gown, etc.,

and arranges the coverings. The patient is then left entirely to the anæsthetist until he announces that anæsthesia is established. Then Nurse IV uncovers the area of operation, removes bandages, and arranges the mackintoshes and aseptic towels carefully and evenly. The surgeon then proceeds with the operation. His wants are as much as possible anticipated, and his orders obeyed quietly and without hurry; if there is any difficulty the nurse must refer to the house surgeon.

When the operation is finished, the dressing, previously prepared, is to be handed to the surgeon by Nurse II; Nurse I meanwhile removes the mackintoshes and towels and Nurse IV goes for the porters to convey patient back to the ward.

#### INSTRUMENTS.

1. The instruments are to be kept on their proper shelves.
2. They must all be examined weekly, dusted, and polished.
3. It is better to put out more instruments than are required than too few.
4. All instruments (if their structure admits

of it) are to be prepared for an operation by boiling in a solution of soda ( $\frac{1}{2}$ -oz. to pint) for ten minutes. From this they are lifted and placed in the porcelain or glass tray containing either 1-40 carbolic acid or plain sterilized water.

5. If any instrument fall on the floor it must be touched by Nurse IV only, and if required again must be re-boiled at least for two minutes before being handed to the surgeon.

6. After the operation all instruments are to be cleaned thus :—

- (a) Thorough mechanical removal of all blood clot, etc., with the nail-brush in warm water
- (b) Dry, and polish with paste
- (c) Boil in the soda solution for ten minutes
- (d) Carefully dry.

### SPONGES.

1. When not in use to be stored in air-tight glass jars, containing 1-20 carbolic acid.

2. From this they are taken half-an-hour before operation and immersed in a bowl containing 1-2000 biniodide of mercury.

3. In this they are to be handed to the surgeon when required, or wrung out by Nurse II, as he may prefer.

4. Enough sponges are to be in use to avoid unseemly hurry in cleaning them during the operation, and Nurse III shall, on every occasion, note their exact number on a slate provided for the purpose.

5. Soiled sponges are to be received by Nurse III in a surgically clean lotion bowl and transferred to the basins of warm sterilized water and soda, where they are to be freed from blood and discharges. They are then returned to the bowl of 1-2000 biniodide of mercury held by Nurse II in readiness for the surgeon.

6. After the operation they are to be cleaned thus :—

(a) Wash in warm water.

(b) Wash in soda solution (warm)

(c) Wash again in warm water

(d) Store in glass jar containing 1-20 carbolic acid.

7. If the sponges are discoloured they are to be allowed to stand for twelve hours in a solution of sulphurous acid (20 per cent.) before being immersed in the carbolic acid.



8. If the surgeon prefer to use gauze mops, these are to be placed in the 1-2000 biniodide of mercury and handed to him in the lotion bowl.

### SUTURES AND LIGATURÉS.

1. The materials for sutures and ligatures are catgut, silk, silkworm-gut, horsehair and silver wire.

2. Catgut must not be boiled. It is supplied sterilized in bottles. These are to be opened with surgically clean hands, and the gut wound on the glass reels in the tank provided. This tank is to contain a 1-20 solution of carbolic acid; it is to be cleaned and re-filled weekly.

3. Silk is supplied either in hanks or on reels; before storage in the tank, it is to be boiled for ten minutes in the soda solution. It is also stored in 1-20 carbolic acid solution.

4. Silkworm-gut and horsehair are used for sutures alone, and are to be boiled before storage, and kept in a solution of 1-20 carbolic acid.

5. The lotion in all the suture jars or tanks must be changed at least once a week.

6. Silk, silkworm-gut, and horsehair may also be boiled before each operation in the metal box provided for the purpose.

7. It is sufficient if silver wire be prepared thus before each operation.

### BRUSHES.

1. New nail brushes must be boiled once for five minutes.

2. If a brush be used at operation it must be thoroughly washed in soda solution to remove all blood and discharge, and then soaked for twelve hours in 1-20 carbolic acid.

3. If the brush be used on a case with septic discharge, it must be burnt.

4. The theatre nail brushes must be renewed once a month at least.

### DRAINAGE TUBES

are stored in 1-20 carbolic acid solution. They are to be taken out and boiled weekly, and replaced in fresh solution.

### CATHETERS

are either metal, gum-elastic, or rubber.

1. The catheter boxes are to be thoroughly cleaned, weekly.

2. *Before and after use* the metal and rubber catheters are to be cleaned, first in warm water

with a syringe, and after that boiled for some five minutes.

3. The gum-elastic catheters must not be boiled, but after preliminary cleaning must be immersed in 1-20 carbolic acid some six hours.

### DRESSINGS.

1. Dressings are expensive and must be economised.

2. Nurses must never use wool where tow would serve the same purpose.

3. The dressings are stored in the wards in boxes provided for the purpose. These must be kept scrupulously clean, and the dressings arranged neatly in the proper places.

4. *Dressings must be touched only by surgically clean hands.*

5. The preparation of dressings is one of a nurse's most responsible duties, and must be done with excessive care as regards surgical cleanliness, amount, shape, etc.

6. Dressings are preferably, and, if possible, sterilized by heat before use.

7. Gauze is the usual dressing next the surface of a surgical wound. For operation wounds gauze must be carefully cut, then boiled

in the sterilizer for five minutes, then immersed in either carbolic acid 1-60, or 1-4000 biniodide of mercury, or in the water in which it has been boiled. Here it remains until required by the surgeon.

8. Gauze, wool, gutta-percha tissue and other dressings must on no account be cut on any other surface than a *clean mackintosh spread on a table*.

9. Nurses must also, before spreading ointment, cover the table, etc., in the same way.

10. For use in the wards dressings must be carefully prepared some time before the ward visit—they cannot be properly prepared in a hurry.

11. They are to be taken from the store box and cut and arranged as required for each patient. If sterilized in the steam sterilizer, each dressing should be in the dressing box between layers of paper on which the name is written, and in reverse order to that in which they will be required.

If not sterilized thus, the gauze is to be put into the ward sterilizer and boiled for five minutes, while the wound is being uncovered.

12. Gauze and lint are to be handed to the

house surgeon in the lotion which is being used for the time being.

13. The other covering dressings are handed by the sister as required.

### TOWELS.

1. Those used for isolating the area of operation must be carefully prepared by boiling for ten minutes, and, if the surgeon choose, by subsequent immersion in an antiseptic lotion.

2. Towels used in the wards for a similar purpose must be similarly treated.

### MACKINTOSHES.

Mackintoshes are to be cleaned in the following way :—

(a) Remove blood, etc., with tow.

(b) Scrub in bath and remove stains with soap.

(c) Wash in 1–20 carbolic.

### LOTIONS.

1. All water used to dilute lotions is to be boiled.

2. Such boiled water must be prepared at a sufficient time before an operation or ward visit, for it to cool to the proper temperature.

3. It is better to have it too cold than too hot, as the temperature can always be raised by the addition of a small amount of boiling water.

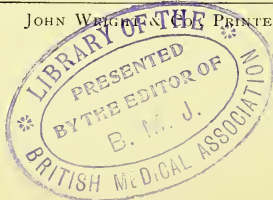
4. The nurses are responsible for the proper labelling of the lotion bottles.

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